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THE DIAGNOSTIC VALUE OF THE WOODY ARITHMETIC SCALES: A REPLY. PART I

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In the issue of *School and Society* for October 6, 1917, an article appears by Dr. Walter S. Monroe entitled "An Experimental and Analytical Study of Woody's Arithmetic Scales." In view of the extended use attained by the Woody scales during their first year and a half, this title is unusually attractive. The author of the article states that "It is the purpose of this study to learn how completely it is possible for these scales to diagnose a class, and how accurate is such diagnosis as they make." The article is characterized by an absence of any thoroughgoing attempt to show what merits the tests possess as diagnosing instruments and by an effort to prove the author's main contention that they do not diagnose through attempting to show in a rather superficial way that the Cleveland Survey tests do diagnose. The article does a grave injustice to both series of tests and to the cause of educational measurements, because it fails to reveal the real diagnostic powers of either of the tests. An untrained reader might very readily conclude that neither test possessed much diagnostic merit.

It is not the purpose of the present writers to attack the statement that the Cleveland Survey tests can be used to diagnose. In fact the great number of examples of various types which they contain make them quite comprehensive and useful for the purpose whenever sufficient time is available for examining fully the symptoms revealed. We shall however in the first part of this paper attempt to answer the principal criticisms which Dr. Monroe has made of the Woody tests. In the second we shall endeavor to point out some of the possibilities of the tests as diagnosing instruments.

I

In the first place, to diagnose means more than to find class scores and to compare them with established standards. The article referred to above treats diagnosis in this limited sense. So long as a diagnosis is only in terms of standards of attainment, it is superficial. It must go further. It must reveal the particular processes in which pupils fail, not necessarily the examples. It must reveal the particular mental processes or habits at work which are the seat of the difficulty. When a third grade child adds example 3 of Woody's addition test $\frac{17}{2}$ and obtains 10 as the answer, it is of little service to treat this merely as an error. The fact to be considered is that the child has added two, seven, and one, and obtained ten. This habit must be broken down and the habit of two-column addition built up before the child can be expected to progress satisfactorily. In any case a diagnosis must seek to reveal the mental processes at work tending to produce failure. Hence we must not be led astray by assuming that Dr. Monroe's exhibit of scores made on the Woody and the Cleveland Survey Tests represent the diagnosing merits of either test. Some conception of the diagnosing merits of the Cleveland Survey Tests may be had by reference to Counts' study.*

Monroe contends quite correctly that "arithmetical ability" consists not of a single ability, but several abilities. He points out for instance that Ballou records 14 types of examples in the addition of two fractions. This makes way for his first criticism of Woody's tests, namely, that they do not include all important types of examples required to test these several abilities. In reply it may be said that while the greater number of types may be admitted, it does not necessarily follow that children must be tested on all of them before fundamental weaknesses in the work of a class can be discovered. The tests do not contain all types and it is not essential to a working diagnosis that this be the case. A working diagnosis must furnish clues as to the most probable causes of failure—clues whch can be used as starting points for remedial measures. This the Woody tests do. When a teacher discovers that a number of pupils in attempting to add fractions where the

*GEORGE S. COUNTS. *Arithmetic Tests and Studies in the Psychology of Arithmetic*, University of Chicago Press, Supplementary Educational Monographs No. 4, 1917.

addition is indicated by the + sign, add numerators to numerators, and denominators to denominators, or that some add numerators to denominators, it is not necessary to extend the testing to all types of examples in fractions. In one small class of nine sixth grade pupils tested by Woody's Addition Scale, Series A, six added numerators to numerators and denominators to denominators, in each of the six examples in addition of fractions where the addition is indicated by the plus sign, *e.g.*, in example 27, $^1/_8 + ^1/_4 + ^1/_2 =$, the answer $^3/_{14}$ was obtained through such a process. In this school the course of study calls for addition of fractions, including the types indicated by these examples, in grade five. The results of the test are good evidence that the subject was not well taught, and the prevailing type of error indicates the nature of the remedy.

Furthermore, we must not lose sight of the fact that a satisfactory test must have commendable administrative features as well as supervisory and psychological values. While a test must afford a working diagnosis of teaching needs, at the same time it must be such that it can be readily administered. For that reason it cannot contain an unduly large number of examples. The inference which the writer leaves us to draw, namely, that the Cleveland Survey tests provide more types of examples than do the Woody, is not founded upon fact, as one may see by a careful comparison of the two series of tests. All things considered, Woody has combined the essentials of a good test and scale to a remarkable degree. To meet all the requirements that Mr. Monroe is asking would necessitate tests of unwarranted length and tests which would require more labor to summarize properly and interpret than most school systems can afford. The four Woody tests require eighty minutes as it is.

The criticism of the tests on the ground that the diagnosing power of a test is limited to the types it contains is rather unjust. By following up the test with slightly different examples of about the same degree of difficulty, one may discover other weaknesses than that expected from a given type of example itself. Furthermore, in all testing a basic assumption is that the examples or questions selected represent a random selection of the entire field. If correlation studies have shown us anything, they afford grounds for believing that if pupils are weak in particular types of examples, they are very apt to be weak in types somewhat similar. Hence

when wrong or confused mental habits are discovered, it is not necessary to test on all types before we can predict certain types on which they would probably fail.

Dr. Monroe makes the statement that "a satisfactory diagnosis must either be complete, or, if not, its limits must be known. Otherwise the mistake will be made of assuming that a partial diagnosis is complete." In reply we may say first, that we know something of the limitations of the test when we know that it does not contain all types or ramifications of types of examples. Nowhere does Woody claim that his tests will furnish a complete diagnosis. He does say that they will "aid greatly in locating the weaknesses of the class,"* a statement not out of keeping with the truth. Second, a satisfactory diagnosis need not necessarily be complete in all details. A diagnosis is satisfactory which reveals a number of specific class weaknesses or incorrect habits formed which are causing errors. The teacher desires to know where to attack in order to bring about improvements. She does not attempt to remedy all weaknesses at once. As we have said the most serious of them furnish her with starting points. If she be at all competent she will make use of additional examples somewhat similar in nature, and difficulty in order to discover other limitations of the class.

For the purposes of diagnosis it is not so important to know how many errors were made on particular examples as it is to know what is causing the errors. There is a vast difference between errors as such and recurring errors of a similar nature, caused by the same mental processes or habit. This is a distinction which the writer of the article apparently disregards when he discusses the diagnostic features of tests. When several pupils in a class give the same incorrect answer to an example, or when several errors of a similar nature are made by an individual, the difficulty can usually be traced to a single source, *e.g.*, in answer to example 16 of the subtraction test $\begin{array}{r} 270 \\ 190 \\ \hline \end{array}$ it was found that 120 was given by a number of children in several classes in one city. How to account for it was for a time a puzzle. It finally developed that it was probably due to an insufficient familiarity with the Austrian method of subtraction. The mental processes involved after putting down the cipher was somewhat as follows: "Seven and what number

*CLIFFORD WOODY. *Measurements of Some Achievements in Arithmetic*, p. 23.

make nine? Put down two. One and what number make two? Put down one." Example 18 of the subtraction scale 1000 was us-
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ually solved similarly by the same pupils. It was discovered that these children in the second and third grades had been taught to subtract by the common method of borrowing The present teachers of these children, now in grades four and five, use the Austrian method, teaching subtraction as a form of additon. Hence the confusion. Now to have treated the answer 120 to example 16 merely as an error would not be diagnosing an evident need of this class. To discover the mental process back of the error is to diagnose. The number of such mental processes causing errors which can be discovered through the use of the Woody tests is sufficient to furnish reasonably satisfactory diagnosis of teaching needs.

A third objection is raised on the ground, that Woody, as Monroe claims, has used the statistical rather than the analytical method of selecting his examples. As a matter of fact, Woody has used a combination of the two methods. We wrote to Dr. Woody for a definite statement on this point. In a reply he says "The problems for my scales were chosen primarily for the purpose of analysis of errors made by pupils."* Statistical considerations were secondary. Nearly every example was selected because it added some new feature not contained in others already chosen. The examples rejected because of their failure to meet certain statistical requirements were few as any one may discover by correspondence with Dr. Woody himself. In this letter he states that "Those problems which were rejected had a particular characteristic which made them more or less local in their nature. By local I mean such a peculiarity that a class in the third grade would understand the meaning of such a problem while a class in the fourth would not." He says further with reference to the statistical selection of examples in Series "A"—"The steps were not equal between the different problems. This is due to the fact that the problems were arranged in order of difficulty and given that particular order because I did not wish to throw out problems merely from a statistical point of view. I preferred to retain the problems because of their diagnostic value rather than throw them out because they did not make uniform steps which a statistical scale would be inclined to do."

*Letter of January 23, 1918.

One decided advantage gained when we select examples in order of increasing difficulty, as we do when we use the statistical method, is that we obtain a graded series. The advantage of such a series in determining achievement in arithmetical abilities is one which should not be overlooked. This feature of Woody's scales resulting from the use of the statistical method is one for which no other set of tests in fundamental operations provides to a like degree, and it is one whose value Dr. Monroe fails to consider at all in his criticism of the statistical method of selecting examples.

Another objection to the statistical method of selecting examples is raised by the writer of the article because only those examples were chosen which were solved by a gradually increasing percentage of pupils from the lower to the higher grades. The writer states that "Under normal conditions the per cent. of pupils doing the examples correctly should not increase gradually from the lower to the higher grades." He does not take into account the fact that a gradual increase in the sense used by Woody means that *beginning with the grades in which some of the pupils are able to solve a given example there should be a gradual increase* in the percentage of pupils in each grade above who solve it correctly and *not a decrease* from one grade to the next.

Moreover, Woody attached no weight to scores made on examples solved by less than 2.15 per cent. of the children in the grade (*i.e.*, at a distance greater than 3 P. E. from the median of the distribution for the grade) in locating the examples on the scales. Examples solved by more than 2.15 per cent. but less than 25 per cent. (*i.e.*, between 1 P. E. and 3 P. E. from the median) were given only half weight. Thus no one need be concerned about the importance attached to examples much too difficult for children of the grade in making up the scales.

The writer of the article states that "Before a type of example is taught a pupil can not be expected to possess the ability to do it." Nevertheless, much to our surprise, the child sometimes does. But however that may be, we know of no one who contends that he should. Certainly Woody does not, for nowhere in his monograph do we find a statement to the effect that he does. Monroe says further that "at the time in his school career when it is taught he will learn more rapidly than afterwards." He refers to the median achievement of pupils on the Cleveland Survey Tests as tending

to support his statements. For the benefit of the reader the table showing these scores is reproduced here, Table I. Dr. Monroe calls particular attention to the scores on examples in fractions.

Tests H and O as used in the Cleveland Survey are tests in fractions. These figures indicate no score for grades 3 and 4 on test H and for grades 3, 4, and 5 on test O. Evidently the type of example included in test H was first taught in grade 5 and that of test O in grade 6. Obviously the changes in score from 0 in grade four to 5 in grade five on Test H, and from 0 in grade five to 3.1 in grade six on Test O, appear large. But this change can not well be in-

TABLE I

*Medians in Each Arithmetic Test for All Grades—Cleveland Survey**

Test	Grade 3	4	5	6	7	8
A	13.4	17.8	22.2	24.8	26.7	27.5
B	9.3	13.4	17.2	19.8	21.5	26.0
C	6.5	12.0	15.5	16.6	17.7	19.0
D	6.3	12.4	15.7	18.5	20.8	22.5
E	4.3	5.3	6.3	6.8	7.5	7.8
F	2.0	4.9	6.7	7.5	8.6	10.1
G	2.0	3.9	5.2	5.5	5.9	6.6
H	0.0	0.0	5.0	5.5	7.7	8.5
I	0.6	1.1	2.0	3.1	4.0	4.7
J	1.9	3.2	4.0	4.4	4.9	5.7
K	0.0	4.0	6.8	8.5	10.1	12.5
L	0.0	1.7	2.5	2.8	3.2	3.9
M	1.4	2.5	3.2	3.8	4.4	5.1
N	0.0	0.8	1.3	1.7	2.0	2.6
O	0.0	0.0	0.0	3.1	4.1	5.5

terpreted as a "*gain from grades four to five*" *much larger than the improvement between subsequent grades.* The figures indicate rather a change from a condition of *no ability* before the examples have been taught to a condition of *ability* resulting from the teaching. After this ability appears there is an uninterrupted increase throughout the succeeding grades for both Test H and Test O. Moreover Table I shows, for nearly all of the other tests, a similar regularity of improvement from grade to grade. This may be seen graphically for a number of the tests from Figures I and II. The curves for tests E, F and I, shown in Figure I, represent tests in addition,

*From CHARLES H. JUDD: *Measuring the Work of the Schools*, Table X, page 98.

subtraction and short division respectively. Test E is composed of single column addition examples of five numbers. Test F includes examples of the type 1269, and Test I of the type

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6)57432. In none of these is there anything but a gradual improvement from grade to grade. Moreover, were one at first thought inclined to accept Monroe's assertion that "at the time in his school career when it is taught (*i.e.*, a given type of example) he will learn more rapidly than afterwards," he would have evidence from Test F that the statement is far from true. The median score for the fourth grade is more than double that of grade three.

In Figure II, tests L, N and O are represented. Test L is a test in multiplication of four place numbers by two place numbers. Test N is a test in division of the type 48)28464, and test O is a test in fractions. The curves for these tests confirm the evidence of gradual improvement shown in figure I. Certainly the facts of Table I from the Cleveland Survey Tests cited by Dr. Monroe do not offer satisfactory evidence to support his objection to Dr. Woody's statistical method of selecting examples. Still another objection is offered to the Woody tests on the ground that too few of the fundamental combinations are included. He asserts that the addition test, for example, includes only two examples in fundamental combinations. The addition scale has in effect not only two examples, but six that offer pupils an opportunity to exhibit their knowledge of the fundamental combinations. All but number two of the first seven examples, call for fundamental combinations. As may be seen they are additions of two numbers without carrying.

(1)	(3)	(4)	(5)	(6)	(7)
2	17	53	72	60	3+1=
3	2	45	26	37	

Though an example may be of two columns, it serves to diagnose ability in the fundamental combinations so long as carrying is not required, *e.g.*, example 5, 72 gives a child an opportunity to exhibit

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his knowledge of the combination 6 and 2, and that of 2 and 7. In the subtraction test there are ten examples, numbers 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, that are essentially fundamental combinations. These are:

8	6	2	9	4	59	78	7−4=	76	27
5	0	1	3	4	12	37		60	3

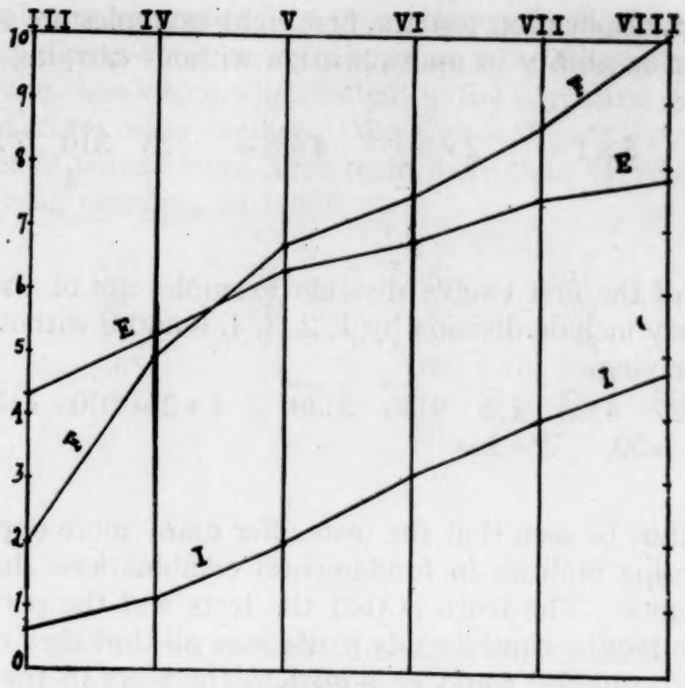

FIGURE I

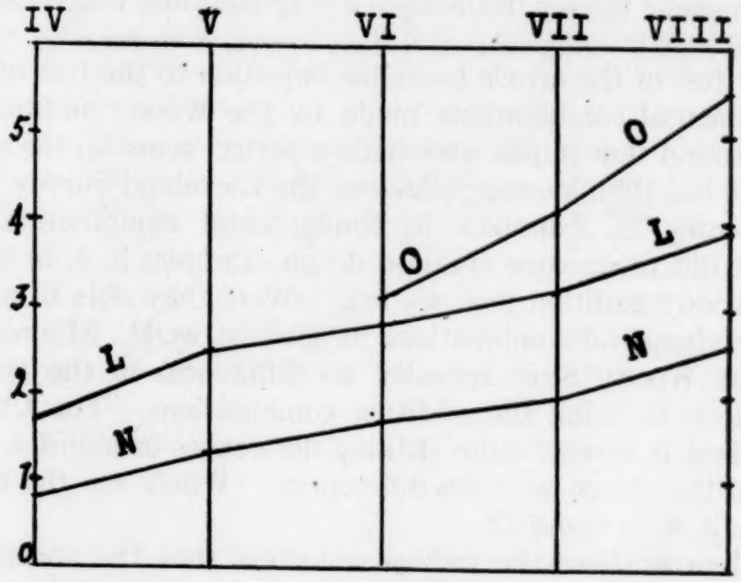

FIGURE II

In the multiplication test the first eight examples are serviceable for measuring ability in multiplication without carrying.

$3\times7=$ $5\times1=$ $2\times3=$ $4\times8=$ $\begin{array}{r}23\\3\\\hline\end{array}$ $\begin{array}{r}310\\4\\\hline\end{array}$ $7\times9=$ $\begin{array}{r}50\\3\\\hline\end{array}$

Eleven of the first twelve division examples are of the simplest kind. They include division by 1, 2, 3, 4, 6 and 9 without remainders or carrying.

$3\overline{)6}$ $9\overline{)27}$ $4\overline{)28}$ $1\overline{)5}$ $9\overline{)36}$ $3\overline{)39}$ $4\div2=$ $9\overline{)0}$ $1\overline{)1}$

$6\times\ldots.=30$ $2\div2=$

It will thus be seen that the tests offer many more opportunities for diagnosing abilities in fundamental combinations than appear at first glance. The truth is that the tests and the performances upon them require careful study to discover all that they can reveal. Not many examples could be added to the tests in their present form without necessitating the elimination of others. Monroe in demanding numerous additions to the tests strangely enough fails to indicate any desirable eliminations. To increase materially the number of examples on the test would as we have pointed out elsewhere make the use of the tests a very laborious and burdensome process.

The writer of the article bases his objection to the test of ability in fundamental combinations made by the Woody addition scale on the ground that pupils who made a perfect score on the example

$\begin{array}{r}2\\3\\-\end{array}$

made less than average scores on the Cleveland Survey Test A, consisting of examples in fundamental combinations. But what did these same children do on examples 3, 4, 5, 6, and 7 of the Woody addition test, we ask? Were they able to make all of the fundamental combinations in these as well? Monroe states "that the Woody Scale revealed no differences in the ability of these pupils in using the addition combinations. The Cleveland Survey Test A reveals quite striking differences in abilities." But is it true that there were no differences? Where are the facts on examples 3, 4, 5, 6 and 7?

Dr. Monroe raises the further objection that the addition test

contains only one example of the type of example 18 which is 2563
He reports a ninety-three per cent. score on this example by a 1387
seventh grade class which when tested by the Cleveland Sur- 4954
vey Test M scores below average. Woody has at least six oth- 2065
er examples of two or more columns in more than two num- ——
bers, requiring carrying, as follows:

(11)	(13)	(15)	(16)	(17)	(22)
32	23	100	9	199	547
59	25	33	24	194	197
17	16	45	12	295	685
—	—	201	15	156	678
		46	19	—	456
		—	—		393
					525
					240
					152
					—

The critic fails to record what this class did on these examples. The same type of ability required in the first three columns of example 18 is represented in example 17. These two examples together with example 15 would give a more accurate idea of the ability of the class to add and carry than 18 alone. To the examples above might be added examples 19, 20, 21, 24, 31 and 33, which, though they involve decimals and United States money, may also be used to diagnose ability in addition. These examples are:

(19)	(20)	(21)	(24)	(31)	(33)
$ .75	$12.50	$8.00	4.0125	113.46	.49
1.25	16.75	5.75	1.5907	49.6097	.28
.49	15.75	2.33	4.10	19.9	.63
——	——	4.16	8.673	9.87	.95
		.94	———	.0086	1.69
		6.32		18.253	.22
		——		6.04	.33
				———	.36
					1.01
					.56
					.88
					.75
					.56
					1.10
					.18
					.56
					——

Apparently the writer of the article has singled out a few examples and recorded not causes of error but rights and wrongs on these few examples, forgetting that there are others in the test. He would have us use the Cleveland Survey Tests which contain but a very few types of examples in addition. They contain one test in simple combinations, two in single column addition, one in addition of similar fractions, one in addition of examples similar to Woody's 18th, and one containing examples in addition of dissimilar fractions. They include no examples in decimals, U. S. money, denominate numbers, or mixed numbers. Without any thoroughgoing attempt to reveal the diagnosing powers of either test he assumes to relegate one test to the scrapheap and to elevate the other upon a pedestal.

Finally, he points to the subtraction combinations on the Woody Scale, nine in number, and to examples 16, 17 and 18, which are:

270	393	1000
190	178	537

as being insufficient to reveal weaknesses in these phases of the arithmetical work. In fact he tries to show that the results attained with them may be materially different from those obtained on similar but longer tests. To substantiate this position he resorts to a comparison of performances made by a single class from each of grades 4 to 8 inclusive on these examples and on the Cleveland Survey Tests B and F which consist of similar examples. In the first place the number of pupils tested was too few to warrant any safe conclusions. Second, he records the average *per cent.* of examples correct on those from the Woody Scale and the average *number* of examples correct on the Cleveland tests. The latter he compares with the standard average on the Cleveland tests, but he fails to record the standard per cent. of examples correct for these examples of the Woody Scale. Such computations obtained by entirely different methods are not comparable. In order to make any sort of comparisons between the two tests from this standpoint, the standard per cent. of examples correct should be calculated. Then it will be possible to say that a given class was below standard as judged by one test or above as judged by the other. From Dr. Monroe's statements one is led to believe that children who scored high on the Woody examples did not do well on the Cleveland tests. For he says of the subtraction combinations, "According to

the Woody Scale the pupils do these examples very satisfactorily * * * * according to the Cleveland Survey Test these pupils are below standard excepting in the sixth grade, and there they are just up to standard." Again he says of examples 16, 17 and 18: "It should be noted that according to Test F the seventh and eighth grade classes are below standard in ability to do this type of example. The Woody scale shows these pupils to stand very high in ability to do examples of this type."

Now are the impressions intended here in keeping with the facts? Table II gives the average and standard number of examples correct on the Cleveland Test B and the average and standard per cent. correct on the examples from the Woody Scale. The last of these are computed from the tables in Woody's monograph.* The others are taken from the tables given by Monroe.

TABLE II

Showing the Average and Standard Number of Examples Correct on the Cleveland Survey Test B and the Average and Standard Percent of Examples Correct for Examples 1, ½, 3, 4, 5, 6, 7, 10 and 13 of the Woody Subtraction Scale

	IV	V	VI	VII	VIII
Average Cleveland Survey Test B....	10.6	12.7	19.3	18.3	18.
Standard average survey test B.....	11.3	16.	18.3	21.4	24.4
Average per cent of examples correct Woody Scale.....	96.	99.	99.	97.	96.
Standard per cent of examples correct Woody Scale.....	92.9	97.4	98.6	98.8	99.4

TABLE III

Showing Facts Similar to Table II for the Cleveland Survey Test F and for Examples 16, 17, 18 of the Woody Subtraction Scale

	IV	V	VI	VII	VIII
Average Cleveland Survey Test F....	1.6	4.9	7.4	7.7	7.2
Standard average survey test F.....	3.9	6.4	7.3	9.	10.2
Average per cent correct Woody Scale	54.	76.	92.	86.	90
Standard per cent correct Woody Scale	49.	79.	87.	93.	95.

*Ibid., Tables XI and XXII. The order and numbering of examples in Table XI is that used by Woody in collecting the original data and differs from the present order on the scale. Table XXII furnishes a key to the corresponding orders.

It is to be observed from Table II that when measured by either test grade six is above standard and grades seven and eight are below. Thus for these grades the two tests do not point to different conclusions. According to Table III,* grade six is again above standard on both tests and grades five, seven and eight are below standard on both tests. This is far different from what the writer would have us believe. Even from his own figures, derived as they are from but one class in each grade, the tests are shown to point in the same direction. The assertion made that "The Woody Scale shows these pupils (*i.e.*, grades seven and eight) to stand very high in ability to do examples of this type" does not accord with the facts. The two tests do diverge in grades four and five of Table II and in grade four of Table III. Two possible explanations may be offered. Tests given to more than 7000 Wisconsin children indicate that Woody's standards for each of his tests are too low in grades four and five. Standards in both tests probably need refining. Then the element of speed may be more effective in these grades. The averages on the Cleveland tests are based upon scores made in thirty seconds. They do not represent the ability to do examples of a given type, but the ability to do a given number of them in thirty seconds, two quite different things. Furthermore, one might well question the validity of results obtained from a limited number of pupils in so short a time. An error of ten per cent. in either direction in the time actually taken by a class is not impossible or unusual. From the facts which Monroe has given us we must conclude that the writer of the article has failed to substantiate his claim that the Woody test in subtraction contains an insufficient number of examples of the type just discussed, and that conclusions drawn from it may be misleading.

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*The standard per cent. correct for the Woody examples is computed from Table XXIV of Woody's monograph. See his Table III column headed "Subtraction," and Table XXV column "Final Value," for the key to corresponding orders.

(*Part II will appear in the December number.*)

CORRELATIONS OF IMMEDIATE AND DELAYED RECALL

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A considerable number of studies have accumulated bearing upon the general relation of "speed of learning" and "retentiveness," yet authorities disagree widely in their interpretation of these results. The terms "speed of learning," "retentiveness" and the like give scarcely an accurate description of the facts, since "speed of learning" has been determined in nearly all cases by an objective measure of the amount of material recalled at a certain time, viz., immediately after a study period and likewise "retentiveness" is determined by a similar measure of amount recalled at a particular later time. It will be seen that the terms "immediate recall" and "delayed recall" give a more accurate description of the functions concerned in the present experiment.

With regard to interpretation of previous studies, we find in current textbooks such conflicting statements as these:

"The one who learns quickly, ... retains it just as long and on the average longer than the one who learns more slowly . . . . Quickly come, slowly go."*

Pillsbury takes a middle ground:

"Individuals who learn easily seem to forget slowly while those who learn slowly forget rapidly. This law holds if one considers pure rote learning. When learning sense materia by logical connections, the man who learns slowly may have an advantage if he gives the added time to understanding the matter. In this case the evidence shows that slow learning is compensated for by retentive memory."†

At the other extreme is Meumann, from whom pertinent statements are quoted. "Learners may, in general, be classified into two groups; rapid learners and slow learners . . . . . each represents a characteristic mental type. The typical differences persist no matter whether the material to be learned is of significant or a meaningless sort . . . . The typically rapid learner is usually a rapid forgetter. The rapid learner possesses no guarantee of permanent retention. The profit which the slow

*STRAYER AND NORSWORTHY. *How to Teach*, N. Y., 1917. p. 81.

†W. B. PILLSBURY. *Essentials of Psychology*, N. Y., 1914. p. 198.

learner derives from practice is, in most cases, relatively much greater. The rapid learner is always found to be at a disadvantage when called upon to reproduce freely without re-learning."*

These statements of Meumann are an illustration of the doctrine of compensation which have been widely voiced by German psychologists. The belief in negative correlations between desirable traits, as the quotation well shows, has usually gone hand in hand with the attempt to classify individuals into types.

Thorndike, in his survey of correlational psychology, has vigorously assailed this doctrine:

"It should be noted that in original nature the rule is correlation, not compensation . . . . . It is very, very hard to find any case of a negative correlation between desirable mental functions. Divergences toward what we vaguely call better adaptation to the world in any respect seem to be positively related to better adaptation in all or nearly all respects. And this seems especially true of the relations between original capacities."†

It is in connection with the relation of learning and retention, as measured by immediate and delayed recall, that much difference of opinion regarding correlation has arisen. A goodly number of researches have shown that much depends upon the method of testing recall; by choosing the method, one predetermines the result.**

In general these statements seem justified:

1. For this particular purpose, delayed recall should not be measured by relearning since the quicker learners, other things being equal, would excel, on that account, in the relearning test as well as in the original test.

2. The method of allowing the subject to complete the original learning by themselves—to report when they have "just learned it" —is faulty, since many really overlearn in various degrees the whole or, more often, certain portions. The test then, other things being equal, would show large differences depending on the amount of overlearning.

3. The method of giving a lesson which may be studied a given time, and by a standardized method, resulting in different amounts in immediate recall, seems preferable.††

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*E. MEUMANN. *Psychology of Learning.* 1913 trans. by J. W. Baird. pp. 169 ff.

†*Educational Psychology*, vol. III. p. 362.

**The most complete account of work on this question will be found in LYONS, D. O. "*The Relation of Quickness of Learning to Retention,*" Archives of Psychology, No. 30, 1916.

††See LYON, *op. cit.* p. 16 ff.

Elementary school children (grades 3–8) served as subjects in the present study. The material was of two sorts, non-sense syllables and connected sense material in the form of biographies. The children worked in squads of about 8 each, the amount of material at each lesson being such that the best subjects could recall from 75–90% immediately. The tests with non-sense material were repeated by each subject on 5 different days; in the case of sense material 6 tests were given. For the series of tests with each material, a revolving schedule was employed which neutralized the effects of unequal difficulty of texts, fatigue, diurnal differences and the like. The measure for each individual was the sum of the scores from the 5 or 6 tests. Details with regard to materials and methods will be found elsewhere.*

The following table summarizes the schedules:

Grade	No. of Inds.	Material	No. of tests	Length of each test	No. of hours before retention test
8	43	non-sense	5	9′	4
8	43	sense	6	9′	4
6	39	non-sense	5	9′	3
6	39	sense	6	9′	3
5	38	sense	6	9′	3
4	37	non-sense	5	9′	3
4	37	sense	6	9′	4
3	42	sense	6	7′ 30	3

The time of the study periods was kept constant (9 minutes),† the score being determined by the amount immediately recalled. Methods of study were defined, viz.: all must employ the "whole" method, first reading without attempted recall until, following a signal recall was employed as far as possible. Each student studied at his own tempo, and with or without inner speech as he chose. Retention was tested 3 or 4 hours later (always the same for a given class, of course) by simple recall in the case of nonsense syllables and by writing on the board names of the individuals whose biographies were studied to serve as a guide for recall in the case of the sense material.

**Recitation as a Factor in Memorizing.* Archives of Psychology, No. 40, 1917.

†Except for Grade 3 in learning sense material in which the period was 7′ 30″.

The coefficients of correlation were computed by means of the formula for rank differences:

$$\rho = 1 - \frac{6 \Sigma D^2}{n(n^2-1)}$$

From the values of ρ, the Pearson coefficient r was computed by

$$r = 2 \sin. \left(\frac{\pi}{6}\rho\right)$$

The coefficients of correlation between amount recalled immediately after the learning and amount recalled 3 to 4 hours later, are as follows:

Non-sense Syllables

8th Grade	$+0.73 \pm$	P. E. 0.04
6th Grad	$+0.78 \pm$	P. E. 0.04
4th Grade	$+0.73 \pm$	P. E. 0.05
Average	$+0.7 \pm$	P. E. 0.043

Sense Material

8th Grade	$+0.81 \pm 0.04$
6th Grade	$+0.86 \pm 0.03$
5th Grade	$+0.79 \pm 0.04$
4th Grade	$+0.89 \pm 0.03$
3rd Grade	$+0.80 \pm 0.04$
Average	$+0.82 \pm 0.036$

The evidence is clear that a substantially positive correlation exists between amount recalled immediately and amount recalled 3 or 4 hours later. This has an interesting bearing upon practical affairs but, of course, it is by no means a solution of the relation between "quickness of learning" and "retentiveness." Native retentiveness and other factors being equal, those who recall more immediately after study would recall more after an interval.

Next, consider the correlation between amount recalled immediately and the *proportion of that amount* recalled after the interval. The coefficients of these correlations follow:

Non-sense Material

8th Grade	+0.41+P. E.	0.09
6th Grade	+0.35+P. E.	0.09
4th Grade	+0.42+P. E.	0.09
Average	+0.39+P. E.	0.09

Sense Material

8th Grade	+0.46+P. E.	0.08
6th Grade	+0.42+P. E.	0.09
5th Grade	+0.28+P. E.	0.10
4th Grade	+0.51+P. E	0.08
3rd Grade	+0.40+P. E.	0.09
Average	+0.41	0.09

While these coefficients are not as high as those obtained between amount recalled immediately and amount recalled after 3 or 4 hours, they are high enough and consistent enough to indicate a positive relation. It is my belief, after examining the original data in detail, that one factor has some potency in reducing the present coefficients toward zero. Some individuals *overlearn* certain portions of the material unnecessarily before learning other portions. This would, of course, reduce the total amount immediately recalled and thus move these subjects toward the lower end of the scale. The fact of overlearning, however, would, as regards *percentage recalled later* move them toward the upper limit in that respect, not because they possessed superior retentiveness in general, but because they *overlearned a little rather than just learned much.* The subjects were requested, of course, not to do this, and were required to study by the whole method, but there is certainty that several did overlearn considerably. This seems to be indicated by the fact that the coefficients (following section) of the *percentage* recalled after 3 or 4 hours with teachers' estimates of ability are less than the coefficients of *amount* immediately recalled or the *amount* later recalled with the teacher's estimates. Moreover, these coefficients are subject to another source of attenuation not found in the coefficient between amount immediately recalled and amount recalled later. Neither measure of recall is absolutely accurate, each being subject to various variable errors. When *amounts* are

correlated, the coefficient is subject to attenuation according to the unreliability of each individual's score in each of the two tests, *i.e.*, immediate test and delayed test. But the measure of proportion between the two is subject to the combined errors of both since it is a statement of relation between them. This means an increased attenuation of the coefficients between amount immediately recalled and the proportion of that amount later recalled.

Taking into account the two sources of additional attenuation found in the correlation between amount immediately recalled and the proportion of this amount later recalled, it appears that these coefficients fall considerably below the truth. I should estimate that the coefficients as given above should be raised by a fourth, giving an average coefficient for each kind of material of about +0.50.

Correlation of Immediate and Delayed Recall with Teachers' Estimates of General Intelligence

Teachers of the various grades tested furnished estimates of the general intelligence of their pupils. They used their own conception of "general intelligence" but were urged not to identify it with marks attained in class work and to disregard the pupil's age. The estimate of but one teacher was obtained for each group.

COEFFICIENT OF CORRELATION OF TEACHERS ESTIMATES WITH

	Immediate recall non-sense	Immediate recall sense	Delayed recall non-sense	Delayed recall sense	Percentage retained non-sense	Percentage retained sense
8th Grade	+0.55 P. E. 0.07	+0.55 P. E. 0.07	+0.44 P. E. 0.08	+0.50 P. E. 0.08	+0.43 P. E. 0.09	+0.45 P. E. 0.09
6th Grade	+0.60 P. E. 0.07	+0.54 P. E. 0.08	+0.57 P. E. 0.07	+0.56 P. E. 0.07	+0.40 P. E. 0.09	+0.50 P. E. 0.08
5th Grade		+0.53 P. E. 0.08		+0.59 P. E. 0.07		+0.48 P. E. 0.08
4th Grade	+0.14 P. E. 0.10	+0.28 P. E. 0.09	+0.30 P. E. 0.09	+0.19 P. E. 0.10	+0.21 P. E. 0.10	+0.28 P. E. 0.09
3rd Grade		+0.48 P. E. 0.08		+0.50 P. E. 0.08		+0.48 P. E 0.08
Average	+0.43	+0.48	+0.44	+0.47	+0.35	+0.44

Correlations with teachers' estimates of general intelligence vary from +0.14 to +0.60, two-thirds of the coefficients falling between +0.40 and +0.60. The low values are nearly all produced by the 4th grade. For the other grades the central tendency is approximately +0.50. The different measures of recall correlate about

equally with estimated intelligence, the apparently low coefficients with *percentage recalled* being due to the greater attenuation which obtains in this measure, as just explained.

The findings here obtained are not in conflict with the results of most earlier studies, although some very different values varying from almost perfect to almost no correlations may be found. The median results are most numerous and support a prevalent opinion that (as the present findings indicate) immediate and delayed recall are positively but not perfectly correlated with general intelligence.

The following coefficients indicate the relation of results from the two forms of material used, *i.e.* unconnected non-sense and connected sense material.

	Immediate recall non-sense	Delayed recall non-sense
Immediate recall sense	8th = +0.57±*P. E. 0.07*	8th = +0.58±*P. E. 0.07*
	6th = +0.49±*P. E. 0.08*	6th = +0.48±*P. E. 0.08*
	4th = +0.47±*P. E. 0.08*	4th = +0.24±*P. E. 0.09*
Delayed recall sense	8th = +0.50±*P. E. 0.08*	8th = +0.54±*P. E. 0.07*
	6th = +0.46±*P. E. 0.08*	6th = +0.58±*P. E. 0.07*
	4th = +0.43±*P. E. 0.09*	4th = +0.25±*P. E. 0.10*

A positive correlation, large enough to bear some significance, exists between immediate recall of sense material and immediate recall of nonsense material and between delayed recall for the two materials, and likewise between immediate recall of one kind and delayed recall for the other kind of material. Psychologists, I venture to say, would expect a positive but far from perfect correlation (such as here shown) between such functions. These coefficients are about the same as those between any of the tests and a teacher's estimate of general intelligence or ability.

Summary of Results

(1) A postive and high (0.73 to 0.89) correlation exists between immediate recall and delayed recall when both functions are measured by absolute amounts.

(2) A positive correlation of at least 0.50 exists between the two functions when immediate recall is measured in terms of absolute amount and delayed recall is given in terms of the proportional relation between the two.

(3) All tests of immediate or delayed recall show a correlation with teachers' estimate of general intelligence with a central tendency of about +0.50.

(4) Coefficients of approximately +0.50 are found between the various single tests for the two kinds of material, senseful and nonsense.

(5) The results so far as they go, give a clear confirmation of the contention that correlation rather than compensation is the rule. Meumann's belief that "the typically rapid learner is usually a rapid forgetter" and that "the typical differences persist no matter whether the material to be learned is of a significant or non-significant sort" finds no support in the data.

PEDAGOGICAL SUGGESTIONS FROM MEMORY TESTS

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A complete act of memory requires that impressions shall be retained, recalled, and recognized as familiar and as belonging with certain other impressions. The perfectness of any act of memory depends upon the kind and intensity of the impressions and of the associations between them.

Impressions are of six kinds, namely,—visual, auditory, motor, tactual, gustatory and olfactory, but the first three named are of the most importance in memory. Certain experiments have been made to determine which of these three kinds of impressions are best retained, and to discover the relation existing between recall and recognition.

One of the methods consisted of selecting thirty names of common objects and arranging them in three columns of ten each, care being taken not to put together words commonly associated. The test was made upon the pupils of a typical school and college in all grades from the third primary up. The words in the first column were pronounced to them at the rate of about one every two seconds; those of the second column having been previously writen upon the board, were uncovered one at a time at about the same rate and rubbed out as soon as the next was uncovered; while the objects named in the third column were shown at the same rate. In each case after the ten words were given, the pupils wrote as many of them as they could remember. Three days la er and at the same hour, the pupils were asked to write as many words as they could remember from three columns of ten wo ds each, which were similar to the three preceding columns and which were given orally. In the first column they were asked to think of the sound; in the second the visual appearance suggested; and in the third the objects named.

The following were the averages for the first three lists of words, namely,—6.85, 6.92 and 8.28 respectively, showing that objects were remembered better than the written names, and the latter better than the spoken names. The averages for the last three lists of words were, 6.98, 7.91 and 7.48 respectively, showing that the visual qualities are remembered better than sounds and also better

than objects imaged. In reproduction of the same after three days it was found that mental images of objects were remembered better than their names, which is of great pedagogical significance, indicating that if objects are shown children, or when that is impracticable, if they are led to form mental images of them, they can obtain a genuine knowledge of things more readily than they can be crammed with the verbal appearance of knowledge. There is an increase from the primary department up, in the power of immediate reproduction of words of all kinds but the differences of only about two words between primary pupils and college students is not very great when we remember that it is not so much a matter of memory as it is of mental grasp, and that the younger pupils require longer time to write the words and hence would be more likely to let some of the words drop out of consciousness. In reproduction after three days the college students show no superiority over the children, and perhaps this may be due to the fact that the words were more deeply impressed upon the younger pupils than the older.

Another memory test along on these lines employed series of numbers instead of words. During the Spring of 1891, by permission of the School Board in Worcester, Massachusetts, Dr. Franz Boas of Clark University took certain anthropological measurements of the pupils in the grammer schools, and also made certain tests of eye-sight hearing and memory. The memory tests which were made upon about fifteen hundred pupils in the grammar schools, above the second grade and below the high schools, together with some tests from the normal school, came into the hands of Professor Bolton for xamination. In addition to this and in order to complete the material for all the grades in the public schools, the tests were made upon some of the senior and sophomore pupils in the High School.

The method of making the tests was as follows: A series of numbers in which the digits were so arranged that they did not stand in their accustomed order and no digit was repeated, was read before each class to be tested, and each class was tested on four different occasions. The tests were made in the morning with the exception of two grammar schools, and the normal school, where the purpose was to determine the effect of fatigue, and here two tests were taken in the morning immediately after school assembled and the other two just before the closing of the session in the afternoon. The digits were dictated slowly and distinctly at intervals of about

two-fifths of a second with care to avoid rhythm or grouping, and at a given signal after the dictation of each number was finished, the pupils wrote the digits as they remembered them. In the lower grades of the grammar schools and in the high school twelve observations (a group of five or more digits) constituted the test, and in the eighth and ninth grades only nine observations were made at each test. In the lower grades the first three observations of each test were made with five digits; the second three with six; the third three with seven; and the last three with eight, while in the higher grades and in the high school the first three observations were made with six digits, and in the normal school with seven. The tests being repeated at four different times twelve observations with five, six, seven and eight digits respectively, were made upon each pupil and it would be possible for each pupil to get any number of the twelve correct. An observation was considered correct when only those figures which the teachers had dictated were present in the same order as that in which they had been dictated. It was found that when the observations at each test were begun with five place numbers and gradually increased to eight, the pupils easily grasped the five-place numbers and were led by these to grasp and retain more than they would otherwise be able to do. If the observations were begun with the seven-place numbers before making one with an eight or a nine, the number of figures was not so easily remembered, and more errors resulted from this cause. By classifying the pupils of a particular age or in each grade according to the proportion of the twelve observations on five-place numbers that were correct, and the same for six, seven and eight-place numbers, and marking the percentage that each class was of the total number of pupils in the grade or of the age on thirteen ordinates (twelve for the twelve obsevations and one for those pupils who had none correct) and connecting these points by a line, a curve representing the distribution of the pupils of the age or grade could be obtained, and the maximum of the curve would then show the proficiency of the pupils for the age or grade in remembering five, six, seven or eight-place numbers, as the case might be. Therefore, the various curves which were obtained showed not only the distribution of the pupils according to the ages and the distribution according to grades, but the increasing accuracy with which the older pupils remember a given number of digits. Considering that the tests measure the length of the memory-span, we can conclude that the memory-span increases with the age rather than with the growth

of intelligence, as determined by the tests used in promoting pupils from one grade to another. These tests however do not apply to the retentiveness of the memory, but may be considered more as tests of the power of concentrated and sustained attention. Observations upon the pupils while the tests were being made, seem to indicate that most pupils depend upon their powers of visualization to remember the number of digits, and at the same time they were noticed to repeat the digits as they were dictated.

A comparison of the standing of the pupils in their grades and their ability to remember figures was undertaken to detemine what was the relation between the memory-span and intellectual acuteness of the pupils. As the pupils depend upon their power of visualization, this subject becomes more interesting in determining how far this power is of service in school-work and how closely the power of concentrated and sustained attention is related to intellectual acuteness. For this purpose the teachers in the Oxford and Freeland Street Schools and of the High Schools of Worcester, Massachusetts, were requested to give an estimation of what they considered was the general standing of their pupils with respect to the school work. The pupils were classed as either good, fair or poor, and these classes were compared with three classes which were determined in the memory test by the proportion of correct judgments. The letters of the following table (A representing good, B fair, C poor,) in the left hand column indicate the teachers' classification, and those in the upper line the classification by the memory test.

Table giving the comparison of the teachers' estimation of standing of the pupils, and their standing, as determined by the memory tests. The classes of the teachers are represented as 100 and the others are expressed in percentages.

	A	B	C
A	32.6%	51.0%	16.3%
B	21.4%	58.2%	20.4%
C	24.1%	49.4%	26.5%

Only eight and a half per cent. more of the pupils who were classed A by the teachers have been classed A rather than C by the memory tests. If these tests may be considered as tests of the ability for concentrated and sustained attention and of the power of visualization, we can conclude that these powers are not the only ones concerned in intellectual pursuits and are not sufficient for a successful understanding of intellectual work. Intellectual acute-

ness, while more often connected with good powers of visualization and of concentrated attention, does not necessarily require them, and it cannot be said that those pupils who are bright intellectually are more distinguished on account of their good memories. The fact that a good memory is not necessarily accompanied by intellectual acuteness, adds weight to the conclusion that the growth of the memory does not necessarily accompany intellectual advancement.

In psycho-physical experiments it is customary to take seventy-five per cent. of right answers as the point at which the subject may be safely said to have some knowledge of that concerning which he judges. This standard is chosen for experiments in which a choice is made between two alternatives, where, by mere guesses, the subject will get 50 per cent. correct, but in this test the subject must be supposed to have exact knowledge before he can recall correctly any number of digits. Whatever standard is chosen for these tests, it must be considered as the probability that a certain number of digits should be judged correctly every time. If we then choose seventy-five—though it seems a less figure might be chosen—the results show that all pupils below the 6th grade and over thirteen years of age reach the limit of their memory span at six, and all others at seven. Six may be taken as the limit to the memory span for most grammar and high school pupils.

In order to treat this subject properly a comparison must be made between the boys and girls. For this purpose the boys and girls were classified according to their ages, and in order to get classes sufficiently large to form a comparison it was necessary to put the pupils differing by two years in age instead of one into each class. The probabilities of error were found for each class, and the comparison is made in the following table. Also the ages together with the probabilities of correct judgments are given for each class.

Table showing separately the probability of error for boys and girls.

FIVE-PLACE NUMBERS

	Boys	Girls
Pupils under 10 years	16.	13.7
Pupils over 10 and under 12	10.4	11.5
Pupils over 12	11.5	11.6

	Boys	Girls
Six-Place Numbers		
Pupils under 11 years	47.6	47.9
Pupils over 11 and under 13	35.2	26.5
Pupils over 13	25.4	25.
Seven-Place Numbers		
Pupils under 12 years	65.6	61 6
Pupils over 12 and under 14	50.7	51.
Pupils under 14	51.	44.
Pupils under 14 years	82.4	64.7
Pupils over 14 years	65.4	65.8

From this table it will be seen that in a majority of classes the girls made a decidedly less error than the boys, and in the classes where the boys surpass the girls, it is by a very small figure. This conclusion also harmonizes with the results of other observers.

Tests were also made to determine the unconscious memory and the effect of fatigue in three grammar schools, namely,—Oxford, Freeland and Woodland Street Schools. In the Oxford Street School four tests were taken in the morning and a different series of digit-groups are used at each test. The same digits dictated at the first test were read in the inverse order in the second. They were then completely re-arranged for the third and read in the inverse order for the fourth. Thus the digits in every observation were the same for the four tests, the order alone being changed. The same scheme was used in the Freeland Street School, only two tests were taken in the morning immediately after the school assembled, and two just before closing in the afternoon. In the Woodland Street School the same digit groups were used for the four tests, the purpose being to determine the effect of unconscious memory. The results from all the schools point to the conclusion that the pupils improve with practice. The great uniformity and large increases with each test in the Woodland Street School seem to show that the pupils unconsciously remember the digits that have been dictated one day previous. The probabilities of correct judgment do not show any variations due to fatigue.

The total number of correct judgments for the morning tests in the Freeland Street School was 2,690 and for the afternoon tests 2,640; for the morning tests in the Woodland Street School 6,609, and for the afternoon tests, 7,179. When we consider that great increases were made with each test, and the first test in the Freeland Street School was made in the afternoon, we should expect a greater number of correct judgments for the morning test; and

since the first test was made in the Woodland Street School in the morning, we should expect a greater number of correct judgments for the afternoon tests. This is just what the figures showed, and it may be safely concluded that the pupils suffered no fatigue from their school work, at least none discoverable by such tests as these. Their work was probably not excessive.

A careful examination of the observations show that the types of errors are three and perhaps four in number and these classes of errors represent stages in the fading of the memory-image. In the first place the digits suffer a displacement of order; in the second, other digits are substituted for some that were dictated, and in the third the number of digits is misjudged, either over or under-estimated. Various causes may be assigned for the displacement of order, as when a pupil attempts to write, the attention passes over the successive digits in memory as a rule much faster than they can be written. Before the pupil can write the first digit the attention has passed to the third or fourth and the hand is innervated for the digit that is present in consciousness. The second may be immediately recalled and put in the third place. However, it more frequently happens that the fourth or fifth is displaced than the second or third. Again, the order of the digits in the numbers previously dictated clings in the mind and causes the figures in the next number to be interchanged in accordance with the order. To illustrate,—Two numbers, the first commencing with 8163 and the second with 5136, were dictated. The 3 and 6 in the second were frequently reversed so as to read 63. Further, the order in which the digits stand in our system of notation determines some changes, as for instance, the last three digits of one number were 768 and a very frequent error made was to change the order of the 7 and 6 to 67. A fact that has been noticed frequently in teaching children and also adults is the great liability to confusion, when it is attempted to keep separate two like organs whose functions are diametrically opposed. As in physiology it is a difficult matter for children to distinguish the functions of the right and left ventricles of the heart and even for adults the functions of the dorsal and ventral columns of the spinal cord. It seems probable that this difficulty also appears in keeping the order of two digits that are easily remembered. The inversion of the order is by far the most frequent error as it is also the first to occur. In the second case that of substituting a new digit for one that has been read, there enter some of the causes that bring about an inversion of the order. A digit is substituted for another to make the two stand in the order

they have in the system of notation, or in the order in which they were in the number previously dictated. The likeness in the sounds of the names of two digits often determines the substitution of the one for the other, as 9 and 5 and 9 and 1 are frequently interchanged. The written or printed forms of 9 and 1 probably have something to do with the substitution of the one for the other. The frequent interchange of 3 for 8 is undoubtedly due to the likeness in the form of the printed digits. When a pupil has forgotten the proper digits and also their associations and so drops them out altogether, it shows a more advanced stage in the disappearance of the memory-image. Thirdly, when the pupils over-estimate the number of digits, two tendencies only were noticed. The digits that were supplied were put in the places in the notation system that occurred between two digits already given, or they were placed between two digits which should stand together and which were separated by the supplied digits in some number previously dictated, and when two digits already stand in their natural order, the tendency is very strong to put another digit in order either before or after those given. The second tendency was to repeat some digit already written. Over-estimation of a number was very infrequent, probably for the reason that each test was begun with numbers that could be easily grasped and digits that could be counted.

In the normal school the observations were begun with seven-place numbers; but instead of making three observations, as was done in the grammar schools, with seven digits, the teacher dictated only one seven-place number before dictating an eight and a nine-place number. Again, a seven- and an eight- and a nine-place number were dictated and so on until fifteen observations were made at each test. As results have shown that six figures are all that the best pupils can easily span, the normal school pupils were taxed to the limit of their powers on the first trial. In the grammar schools the pupils were started with numbers they could easily grasp and were led by steps to expect the number of digits in each succeeding observation. On this account 180 pupils from the Oxford Street School over-estimated the number of digits on observation with seven and eight-place numbers 88 times; and 24 normal school pupils over-estimated the number of digits 76 times. This tendency, however, to over-estimate shown by the normal school pupils is not the general rule, as the experiments of other observers like Drs. Hall and Jastrow, have shown that the tendency was to under-estimate the number of clicks made by a quill held against the notched circumferences of a revolving wheel, when the

number of clicks was too rapid to be counted. It would seem then from the preceeding experiments that at the moment when pupils reached the limit of their memory-span, they would over-estimate the number of digits; but if the experiments had been continued with a greater number still, the pupils would have under-estimated the number.

To determine the class of errors which was first to occur, all those observations in which only one kind of error was made, were examined on 105 tests from the fourth and fifth grades.

Table showing the different classes of errors,

	Inversions of orders	Substi-tution	Over-estimation	Under-estimation
Five-place Numbers.....	10	7	3	1
Six-place Numbers.....	44	15	15	5
Seven-place Numbers.....	40	26	13	2
Eight-place Numbers.....	33	10	14	4

If we take observations with a much greater number of digits we should expect that the greatest number of errors would result from the dropping of digits The total number of errors of every class in the Oxford Street School, when compared with the total number of observations, give the following percentages: Inversion of the order, 53 per cent.; substitution, 31 per cent.; under and over-estimations of the number of digits, 15 per cent.

It is very difficult to tell at what places errors are most likely to occur, or in what places the digits are most often forgotten, but as the well-known rhetorical principle runs that the emphatic words in a sentence are the first and the last, so it is with numbers; the first and the last are emphatic and those figures in between are those that are forgotten.

Another method for testing the memory of children at different periods of school life, and to determine what appeals to the different senses and to the sympathies of different ages was that of a story, designed to appeal about equally to different senses and faculties, which was written by Dr. G. Stanley Hall, and divided for examination as here indicated: James: Mack: ten years old: a farmer's son: dreamed: that his father: and mother: died: very poor: and left him nothing: but 37 cents: a loaf of bread: and a Bible: etc., etc. The story contained 324 words and was divided into 152 parts, which were called "terms" for convenience. In this division of the story it was sought to have as many terms as there were distinct facts or ideas. About 700 tests were made in the following schools of Worcester, namely: Woodland Street, Downing Street,

Oxford Street, Winslow Street, and Salisbury Street grammar schools; both high schools, English and Classical, and in one department of Clark University, together with Miss Aiken's School at Stamford, Connecticut. Effort was made to avoid disturbance and to have the same conditions for all; and the pupils were encouraged to make the best possible effort. When a room was entered preparatory to making the test the pupils were told that they were to be given a memory test, in which a story would be read, which would take three minutes. They were requested to give the best possible attention and told that the same test had been, or would be, made in other grades and in other schools. The pupils were requested neither to give nor receive aid, to write on sheets of paper previously placed on their desks as soon as the reading was finished, and to hand the papers to their teacher as soon as they had written all they remembered of the story. In the seventh grade an additional test was made in which the pupils read for themselves. It was made the same hour in the day and, as far as possible, under the same conditions as those where the story was read to them. Typewritten copies of the story were placed on each desk, with the printed side down, together with blank sheets of paper. At a given signal the pupils turned the papers over and were given three minutes to read them. This was sufficient time to read the story at a slow rate and many commenced a second reading, and some probably read the entire story twice in this time. At a second signal they turned the papers back again and commenced writing. The test was not merely one of word memory, nor was it a test in reproducing the thread of the story. A rigid adherence to either plan would in part have defeated the end sought. In the first case would have been the difficulty that many synonyms would have been used to express the same idea, which could not be said to be lost from memory. In the second case, if strict adherence to the order of the story had been required, many papers would have been thrown out, changing the entire nature of the results. All terms which fell below this standard were not counted; but an attempt was made to maintain, as nearly as possible, the same standard in the study of all the papers. Sometimes a sentence would be so constructed that it would contain only one term that could be counted. In such a case the term was not counted, unless it retained its original meaning and it was of such a nature as to indicate that it had its origin in the story. For example, "James dreamed that his parents died," "Parents" was credited for both father and mother. In descending from the higher to the lower grades there was a decided

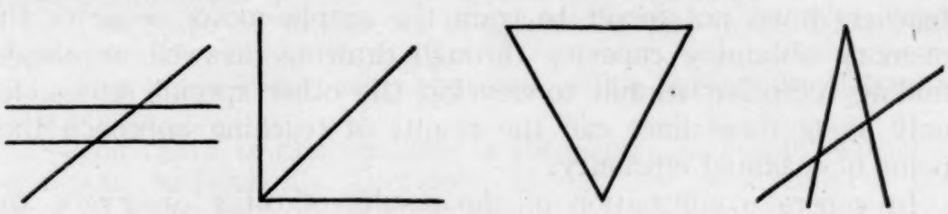
tendency to increase the number of words used to express the same number of ideas. The test was only partially successful in determining what was expected. The appeal to the sympathies and senses was not sufficient to warrant any general conclusion in this direction. No difference between boys and girls in this respect was found, but other important results were obtained. One of the most striking facts brought out was the early age at which children reach approximately their maximum memory power. The boys in the second year of the high school remembered 43 per cent., the highest per cent. for boys. The next highest was 42 per cent. in the ninth grade, while the seventh grade made 37 per cent., one per cent. less than that for the fourth year of the high school. Under these conditions it seems that boys reach their maximum memory power early in the high school period. The girls remembered 43 per cent. in the seventh grade and each high school grade remembered 47 per cent. As a whole, so far as the grades ran parallel, the girls remembered 4 per cent. more of the story than the boys, and no decline of memory power was discovered in the girls. 37 per cent. of the whole story was the average remembered by all grades. This may seem a very low per cent., but it must be kept in mind that the story is a very hard one to memorize.

The highest average attained by any grade was 52 per cent., the amount remembered by a class of 30, in Miss Aiken's school, of the average age of sixteen. This high per cent. is perhaps due to special memory training given to the class. The girls on an average had been in the school for two years. The first third of the story was remembered better than the second third by all grades with one exception, and the second third was remembered better than the last third without exception. The relative difference for the three parts is much greater in the lower grades than in the higher ones. The lowest grade remembered about one-third as much of the last part of the story as of the first, while the fourth year high school remembered 70 per cent. as much of the last third as they did of the first. The marked difference in the seventh grade, where the pupils read for themselves, is probably due to their reading the first part twice. The per cent. remembered by all in the three-part division was successively 46, 38 and 27. Practically the same ratio was sustained by all grades. It seems from the results, that the memories of some pupils act spasmodically. They remember a portion with a considerable degree of accuracy; then they pass on for some distance without getting anything. Others touch, as it were, only the "high places" and so continue through the whole story. Some

with a limited power of reproduction bring out the least expected points and a considerable number remember the first part of the story quite well and remember very little in the latter part. Here fatigue seemed quite clear. Apart from the errors in spelling, in understanding the words, etc., the errors may be classed as errors of omission, insertion, substitution and misplacement. The parts left out were clear omissions, the insertions were due to imagination, the substitutions occurred most frequently where words used in the story had approximate synonyms in the child's vocabulary, and displacements occurred most frequently in the order of the personages mentioned, and where modifiers in one instance seemed well adapted in another. All degrees of inaccuracy were found in the paper, from mere failure to understand a word, to pure products of imagination. For example, James Mack became John Mack, Tommy Mack and Henry Mack, etc. For a story that was written for the test and which did not aim at literary form, but a difficult story for memorizing, the maximum memory power is reached at a relatively early age. The boys in the third grade remembered only 17 per cent. of the story. In the ninth grade they remembered 42 per cent. and in the high school about 40 per cent. From this it seems that memory power for the boys culminates about the beginning of the high school period. The girls made a rapid increase from 18 per cent. in the third grade to 43 per cent. in the seventh grade, and 47 per cent. in the high school. The class in Miss Aiken's school remembered 52 per cent., but this high average is probably due to special training, not usually given in public schools.

Another method of testing the memory was that used by M. W. Meyerhardt of Clark University during the year 1908, who tested respectively the Grapho-motor memory and the Visual-motor memory of college and university students. The method consisted in having the subjects count off numbers in rotation, each individual keeping his number in mind, and placing it upon a booklet with his name and age when passed to him. The booklet contained four figures, one on each leaf, and the subject was told not to open the book until the signal was given to do so. The object of the experiment was then explained and the odd numbered subjects were instructed to write the odd numbered characters and look at the even numbered characters; the even numbered subjects were to look at the odd numbered and write the even numbered characters during the time lapsing between signals which was 10 seconds.

After disposing of all four characters the books were closed and at the next signal (which was to follow 40 seconds after the last one) all subjects were to write the four characters once as they remembered them, on a sheet of paper which was provided for and given out with the book with their name, age and number to be placed thereon the same as on the booklets. The results that Meyerhardt obtained show that in nearly all cases the grapho-motor memory is stronger than the visual-motor memory and that college students are more particular with their drawings than university students. In order to carry the test one step farther the present author was enabled through the courtesy of Mr. G. F. Williams, Principal of Anson Academy, North Anson, Maine, to make about 50 such memory tests on his students in 1909 in the hope that from the results obtained he might further demonstrate the above and prove that not only the grapho-motor memory is stronger than the visual-motor memory, but that the high school students are as much more particular with their drawings, as the college students are more than the university students. The method employed was the same as that used by Meyerhardt with one exception, namely,—that a different set of test figures was used which nevertheless were of about equal difficulty for the subjects to reproduce. The figures used in this set of experiments are reproduced below.



1. 2. 3. 4.

From the results of the experiments on these students of high school grade, whose ages ranged from thirteen to nineteen years, it was found necessary to discard the results of 16 subjects, since they must have misunderstood the directions as given, or else interest was lacking. Probably it was due to the former, for they did not make any attempt at reproducing the figures in the booklet, and for this reason their results could not be counted in the final summary, since it was purely a test of the visual-motor memory and not a test between the powers of the grapho-motor and the visual-motor memories, thus defeating the object of the experiment. How-

ever, the results from the 34 remaining subjects may be said to have met the object of the experiment, and from these it was found that the results harmonized with those of Meyerhardt in that the grapho-motor memory is much stronger than the visual-motor memory. The results from 29 subjects or 85.3 per cent. showed this increase in grapho-motor memory over the visual-motor memory, while the results from the other five subjects showed little difference in their grapho-motor and visual-motor memory capacities. This may be accounted for in part by the above subjects not reproducing the figures but once or perhaps only partially, for in all cases where there were several reproductions of the same specific figure, much greater increase was indicated in the direction of the grapho-motor memory.

Therefore, since the grapho-motor power exceeds the visual-motor power in the capacity of acquiring knowledge through memory, all educational subjects from the graded schools to the university, as far as possible and as far as time will permit, should be taught from the grapho-motor standpoint, as well as by the other special senses. This of course cannot be applied to all subjects alike in the curriculum of our graded college and university school systems, but there may be a most satisfactory application of it in certain educational subjects like the biological sciences and in varying degrees to other subjects in our school curricula. In other words, teachers must not forget to train the grapho-motor sense or the memory obtaining capacity through drawing, as well as always finding receptive stimuli to develop the other special senses, for only along these lines can the results of teaching approach that point of maximal efficiency.

In general confirmation of the results of other observers, the girls were found in these experiments, to make a decidedly less error than the boys. The drawings of the figures as compared with some of those of Meyerhardt from the college students seemed to be at least on a par, and I would say in general terms, that there was a slight improvement over the drawings of those made by the college students.

Additional experiments on students of different high schools would of course have been advisable, but since the results of this set of experiments harmonize so closely with those conducted on students of the college and university grades, the results may be said to be conclusive.

COMMUNICATIONS AND DISCUSSIONS

A CLASS EXPERIMENT WITH THE HILLEGAS SCALE

The following study was made in order to illustrate, for classes in educational psychology, the use of the Hillegas Scale.* Twenty-five short compositions were taken as the material to be graded. These had all been written by college freshmen, and were all reproductions of the story of the "Marble Statue." The judges who did the grading were forty-one women, Junior and Senior students in educational psychology. They had had no experience in grading such compositions.

Each student had a copy of the twenty-five essays, and she was directed to grade them first without the use of any objective scale, giving to each any score from zero to one hundred which she felt that the composition deserved. A week later the use of a scale was explained, and these students were then asked to grade the same set of compositions by means of the Hillegas Scale.

Table I gives the results of the grading of the forty-one judges. In the first column is the number of each composition. Columns two, three and four give results without the scale, and columns five, six and seven give results with the scale. In columns two and five are given the variations in range of the judgments on each composition. In columns three and six are the medians of the judgments, and in columns four and seven are the standard deviations of the judgments on each composition.

An examination of this table shows the following:

1. The range of judgments is absolutely very wide, both with the scale and without it, but

2. The range is less with the scale. The average reduction is 11.5 points.

3. The range of the medians is the same, 32 points, with the scale and without it. Therefore, though the scale reduces the range of judgments on each composition, it does not do so at the cost of reducing the difference between the best and the worst compositions.

4. The standard deviations are reduced in the cases of all except two of the compositions. The average S. D. without the scale being 11.2 and the average S. D. with the scale 8.9.

These points would seem to show that the tendency of the scale is to make judgments more stable.

Another way of inquiring into the effect of the scale is to compute the correlation coefficients for various pairs of judges. It seems fair to assume that if the scale tends to promote uniformity it will

*M. B. HILLEGAS. *A Scale for the Measurement of Quality in English Composition.* Teachers College Publications.

TABLE I

Judgments of Forty-one Students upon Twenty-five Compositions

Without Scale				With Scale		
I. Composition no.	II. Size of Range	III. Median	IV. S. D.	V. Size of Range	VI. Median	VII. S. D.
1	45	65	11.1	41	67	9.0
2	50	65	13.0	35	67	9.7
3	55	75	10.3	48	76	9.4
4	47	85	10.7	40	77	9.8
5	58	68	12.8	47	65	10.2
6	42	75	11.2	37	72	8.6
7	50	75	14.5	38	72	9.6
8	45	68	11.0	33	67	8.8
9	50	70	11.8	38	68	9.1
10	50	80	9.6	38	75	8.6
11	23	90	5.9	22	85	6.4
12	70	75	12.3	36	78	8.8
13	45	80	8.9	32	75	8.5
14	60	74	10.8	41	73	9.1
15	66	58	16.9	35	55	9.9
16	70	60	16.0	48	67	9.9
17	35	80	9.6	32	77	8.1
18	53	75	11.4	45	75	9.8
19	62	69	12.7	40	69	9.3
20	45	80	10.3	37	75	8.1
21	70	70	16.0	55	68	11.5
22	30	85	8.0	36	83	7.1
23	45	70	8.9	34	72	9.4
24	39	80	8.7	34	77	7.8
25	30	85	7.7	25	87	6.9
Average	49.4		11.2	37.8		8.9

tend to raise the correlations between judges. In order to test this point the intercorrelations between forty pairs of judges were computed. For each pair the correlations were figured between their judgments before using the scale, and then between their judgments with the scale. In Table II the numbers in the first column stand for the various pairs of judges. The second and third columns give the Pearson coefficients as between judgments without the scale and with the scale respectively.

TABLE II

Correlations Between Various Pairs of Judges

Pair No.	Without Scale r=	With Scale r=	Pair No.	Without Scale r=	With Scale r=
1	.11	.36	21	.51	.63
2	.25	.49	22	.51	.39
3	.25	.32	23	.52	.39
4	.26	.00	24	.52	.28
5	.29	.26	25	.54	.32
6	.29	.45	26	.54	.67
7	.32	.52	27	.56	.53
8	.35	.19	28	.57	.55
9	.36	.54	29	.57	.39
10	.38	.29	30	.58	.67
11	.41	.35	31	.59	.70
12	.41	.42	32	.59	.51
13	.41	.48	33	.60	.62
14	.43	.27	34	.61	.62
15	.46	.55	35	.62	.63
16	.46	.44	36	.63	.20
17	.47	.45	37	.66	.24
18	.47	.39	38	.66	.78
19	.48	.64	39	.75	.52
20	.50	.57	40	.86	.70
			Average	.48	.46

From this table it appears that the range of correlations without the scale is from .11 to .86, and with the scale is from .00 to .78. The average correlation is .48 without the scale and .46 with the scale. In order to compare the judgments of different groups the forty-one students were divided into two classes of twenty and twenty-one members. The average scores of the twenty-five compositions as judged by the first class were correlated with the average scores as judged by the second class. This was done for the class judgments without the scale and with the scale. By the Pearson formula r = .87 in both cases. By the formula $1-\frac{6\Sigma D^2}{n(n^2-1)}$ the figures were .92 without the scale and .87 with it.

At first thought these correlation results seem to be in opposition to the results as shown in the standard deviations. But I doubt whether there is a true contradiction here. It seems to me compatible to say that, whereas the scale does steady the judgment of a group with respect to its marking of a single composition, it does not alter the judgment, either of the individual or the group, with respect to the relative merits of a series of compositions.

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AN EXPERIMENTAL STUDY OF CHARACTER

Having become interested in the "Experimental Study of Self-Analysis and Estimate of Associates" by Professor Hollingworth,* I have attempted a partial repetition of his experiment, with a somewhat different set of traits. My results, though they do not confirm Hollingworth's in all particulars, in general tend toward similar conclusions.

Twenty-one girls, all living in the same house, were asked to pass judgment upon various traits of character as possessed by their associates and themselves. At intervals of one or two days each girl was given twenty-one slips of paper upon which were written the names of her associates, her own name being included in the list. She was asked to arrange them in order of merit according to the degree of possession of some one trait. This was done for the following traits of character: pleasing personality; beauty, refinement, neatness, enthusiasm, optimism, thoughtfulness of others, leadership, self-esteem, and snobbishness. The experiment was carried out in such a manner that the girls considered their arrangements anonymous, which supposition led them to be honest in the placing of themselves. From the results the arithmetical mean rank was computed for each girl in each trait.

* * * * * * * * *

Hollingworth found a constant tendency toward greater accuracy in judging their associates than in self-estimation. I find this true for the five traits—pleasing personality, enthusiasm, optimism, leadership, and thoughtfulness of others; but do not find it so for the other four—neatness, refinement, self-esteem, and snobbishness as shown in Table I.

TABLE I

Trait	A. D. of Assoc.	A. E. of Self	Trait	A. D. of Assoc.	A. E. of Self
Pleasing personality..	3.8	5.6	Neatness.....	4.2	4.2
Enthusiasm.....	2.8	4.4	Refinement.....	3.9	3.6
Optimism.....	3.5	6.1	Self-esteem.....	3.9	3.6
Leadership.....	2.8	5.5	Snobbishness.....	4.2	3.3
Thoughtfulness of others.....	4.4	5.7	†		

A. D. =average deviation of associates.
A. E. =average error of self-estimate.

Table II shows a tendency to overestimate themselves in refinement, leadership, enthusiasm, optimism; but to underestimate in the case of thoughtfulness of others, pleasing personality, self-esteem

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*"*Vocational Psychology;*" Chapter VII.

†Due to an error in the experiment, it was necessary to omit the self-estimates for beauty.

and snobbishness. Hollingworth found over-estimation in all desirable traits and underestimation in all undesirable traits.

* * * * * * * *

TABLE II

Trait	No. over estimating	No. under estimating	Trait	No. over estimating	No. under estimating
Refinement	12	9	Thoughtfulness of others	9	12
Leadership	11	8	Pleasing personality	7	13
Enthusiasm	10	8	Self-esteem	7	9
Optimism	10	9	Snobbishness	5	16
Neatness	9	9			

*

*Due to an error in method of the experiment, it was necessary to omit the self-estimates for beauty.

By correlating each girl's judgment of every individual in the group with the average, or combined, judgment of the group, a coefficient of judicial capacity was found for each girl. This was correlated with her degree of possession of the various traits to determine whether one who possessed a given trait to a marked degree was a better judge of that same trait in others than was one who was herself deficient in the trait. As shown in Table III, those who possessed the desirable trait of thoughtfulness seemed to be unusually good judges of that trait in others. On the other hand, those possessing snobbishness to a high degree were poor judges of that trait in other people. Hollingworth found a positive correlation of .33 in the case of snobbishness where this experiment shows a negative correlation of .51.

TABLE III

Trait	Cor. betw. judic. cap. and poss. of trait	Trait	Cor. betw. judic. cap. and poss. of trait
Thoughtfulness of others	.87	Pleasing Personality	−.18
Leadership	.45	Enthusiasm	−.01
Optimism	.31	Neatness	−.26
Refinement	.30	Self-esteem	−.26
Beauty	.29	Snobbishness	−.51

In Table IV the various traits are correlated with one another. Those judged as having a pleasing personality were also ranked high in leadership, optimism, enthusiasm, and beauty. Those who were considered good in leadership were ranked high in pleasing personality, enthusiasm, and optimism. Beauty correlated merely with pleasing personality. Snobbishness is correlated negatively or in very slight degree with everything except self-esteem. Those who possessed the greatest degree of snobbishness and self-esteem were considered least thoughtful of others.

TABLE IV

	Pleasing Personality	Beauty	Refinement	Neatness	Self-esteem	Snobbishness	Enthusiasm	Optimism	Leadership	Thoughtfulness of Others
Pleasing Personality..		.72	.66	.44	.32	—.30	.73	.77	.87	.28
Beauty.....	.72		.41	.31	.49	.34	.48	.38	.56	—.20
Refinement.....	.66	.41		.68	.16	—.35	.41	.51	.61	.37
Neatness.....	.44	.31	.68		.14	—.30	.23	.39	.50	.22
Self-Esteem.....	.32	.49	.16	.14		.63	.49	.31	.52	—.52
Snobbishness.....	—.30	.34	—.35	—.30	.63		.10	—.15	.05	—.66
Enthusiasm.....	.73	.48	.41	.23	.49	.10		.74	.87	.10
Optimism.....	.77	.38	.51	.39	.31	—.15	.74		.81	.23
Leadership.....	.87	.56	.61	.50	.52	.05	.87	.81		.18
Thoughtfulness of others.....	.28	—.20	.37	.22	—.52	—.66	.10	.23	.18	

Although these results may have little significance or reliability if viewed alone, they are sufficiently suggestive to indicate the desirability of continuing such experiments.

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SCORING THE MONROE SILENT READING TESTS

Any test of a given ability is of value only in so far as it affords a reliable index of the degree of the ability present. What might otherwise be a very good test is sometimes vitiated by faulty methods of scoring. Not long ago the writer gave to a group of classes the Monroe Silent Reading Tests and the Trabue Completion Test, B Scale. The correlation between the pupils' scores in the two tests was found to be surprisingly low. The results in six classes were as follows:

School	Grade	Correlation (Pearson formula)
L	7 A	.15
L	7 B	.18
P	7	.36
L	6 A	.10
L	6 B	.11
P	6	.27

There is supposed to be the closest correlation between the Trabue Tests and general ability of any tests yet devised. What, then, are we to think of the Monroe Silent Reading Tests? It is my impression that the tests themselves are quite satisfactory, but that the author's directions for scoring are seriously at fault. There are numerous instances where the child surely comprehends

TABLE I

Pupil	Trabue Completion	Monroe Reading Strict Scoring	Monroe Reading Liberal Scoring
1	7	8.2	15.0
2	8	19.3	19.3
3	8	23.0	23.0
4	10	20.9	27.1
5	10	23.0	35.3
6	10	20.9	20.9
7	11	18.2	18.2
8	11	20.3	28.8
9	12	6.4	9.1
10	12	23.6	32.9
11	12	16.6	33.6
12	12	16.5	16.5
13	12	5.2	16.6
14	12	19.3	19.3
15	12	8.6	17.2
16	12	19.3	19.3
17	12	27.6	27.6
18	12	20.3	24.1
19	12	18.2	18.2
20	13	13.8	13.8
21	13	12.1	12.1
22	14	16.5	24.7
23	14	17.2	19.3
24	14	13.9	16.0
25	14	26.8	50.8
26	14	25.5	34.0
27	14	12.2	12.2
28	14	19.7	30.9
29	15	20.3	20.3
30	15	16.1	19.3
31	15	19.3	19.3
32	16	17.1	25.0
33	16	23.0	23.0
34	17	23.0	30.9
35	18	24.4	28.5
36	18	17.2	29.5
Median	12	18.7	20.7

what is read, but does not follow the exact directions in recording the answer. According to the author's directions for scoring the test such responses must be entirely rejected. A more liberal basis of scoring would give the child credit for the test whenever the answer indicates that the substance of the passage has been fairly well comprehended. From grade 6B in School L above 36 papers were received. Of these 21 receive higher scores when graded by comprehension than when graded according to directions. The differences are seen in Table I.

As a result the median of the entire group of 36 papers is raised from 18.7 to 20.7, and the correlation with the Trabue Completion Test is changed from .11 to .63. Most of the differences in the scores are due to the following directions: "If a pupil is asked to underline a word, the word must be underlined and not have a circle drawn around it or a check mark placed after it, in order for the exercise to be counted correct. If a pupil is asked to draw a line around a word, the word must have a line drawn around it in order for the answer to be counted correct." In the rapid work necessitated by the test it frequently happens that the child's attention leaps ahead to the next task, and he becomes careless about following the exact directions in regard to marking. Yet from the word he checks it is obvious that he has understood the passage. A more liberal basis of scoring, therefore, does greater justice to the reading ability of the child.

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PERFORMANCE NORMS FOR THIRTEEN TESTS*

This bulletin is a second contribution on the subject of mental tests, the first having been published under the title of "Eleven Mental Tests Standardized." Twenty-four tests have thus far been described and have been used to supplement other psychometric measures. The bulletin is the work of Investigators Dr. Gertrude E. Hall and Miss Catherine E. Conway who examined 757 individuals by the tests given. In addition to this, 314 school children were examined in an attempt to establish norms. The tests are:

1. Knox Cube Imitation: Test designed by Dr. Howard Knox, Assistant Surgeon of the United States Public Health Service, Ellis Island, N. Y. Material: Four 1-inch cubes four inches apart fastened to a thin board to form a base. One cube for S. and one for E. Movements: Movements are from S.'s left to right.

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*Eugenics and Social Welfare Bulletin No. VIII. New York State Board of Charities, 1917.

LINE	TAP CUBES
1	1, 2, 3, 4.
2	1, 2, 3, 4, 2.
3	1, 2, 3, 4, 2, 3.
4	1, 3, 2, 4.
5	1, 3, 4, 2, 3, 1.
(a	1, 3, 4, 2.
5(b	1, 3, 4, 2, 3.
(c	1, 3, 4, 2, 3, 1.

Summary: (a) Success may be expected of normal seven-year-old children on the first trial. (Fourth line.)

(b) Success may be expected of normal thirteen-year-old children when more than one trial is allowed. (Fifth line.)

2. Three-Number cancellation: This test is similar to the cancellation test described in Bulletin 5 of the State Board of Charities, Bureau of Analysis and Investigation, except that three numbers instead of one are crossed out. The test was designed to test more prolonged attention and concentration than is called for in the one-number test. S. is required to hold in mind the three numbers to be crossed out, to cross them out and to work as fast as possible. Thus the genuine value of the test seems to be what Meumann calls "real capacity of observation," and what Chambers calls "quickness of perception."

Summary: Children from the age of seven years can perform this test when unlimited in time; but when the time is limited to three minutes with from two to eight errors, success may be expected of normal thirteen-year-old children.

3. Recall of Objects: The idea of this test was obtained from the Neurological Institute test of a similar nature, but the method of presentation and scoring is different. The primary object is to test visual memory by using objects. Because of the secondary factors that enter into the test, namely attention, time and ability to follow directions, it was difficult for slow, unobserving children, especially those of the border-line and defective types.

Summary: Normal nine-year-old children can remember seven objects with one misplaced. Normal thirteen-year-old children can remember eight objects with none misplaced.

4. Grouping of Objects: The ten small objects used in the Recall of Objects test are used for an association test. This test was first used by the Neurological Institute. After the former test the ten objects are uncovered and S. is asked to arrange them in pairs, any way he wishes so long as he can account for the grouping afterwards. When S. has finished grouping the objects in pairs he is asked to give reasons for his grouping in the following manner: "Tell me why you put the shoe and the hat together," and so on until each pairing is accounted for in some manner.

Summary: Normal children from the age of seven years may be expected to group the shoe and hat, the gun and hatchet, and the dog with either the chicken or horse. The grouping of the cup, car, chair and either the horse or chicken may vary at all ages. Normal thirteen-year-old children may be expected to account for their groupings. Low grade morons and imbeciles fail on this part of the test.

5. Peg Design: The Bureau of Analysis and Investigation offers the peg design as a simple but interesting learning test. Retentive memory is also tested by the reproduction of the figure half an hour after the first success.

Summary: Success may be expected of normal nine-year-old children. High grade morons may perform this test, but require more time to learn the design than subjects of corresponding ages.

6. Story Reproduction: A simple story was selected by the Bureau for this test, the object being to find at what age children can remember the essential points of the story and reproduce a connected narrative.

Summary: Normal thirteen-year-old children may be expected to give sufficient details to show that they have gained the idea of the story. Morons fail on this test.

7. Syllogisms: To find at what age abstract reasoning may be expected, the Bureau adopted five syllogisms as a test. It was not expected that young children could do much with them, but they were given to the young children just the same as to the older ones to establish their reaction.

Summary: Normal thirteen-year-old children may be expected to form the conclusions of three of the five syllogisms.

8. Four-Detail Drawing: In the belief that drawing is a natural means of expressing ideas, the Bureau of Analysis and Investigation devised the following drawing test, which it is hoped will be a useful supplement to those tests in which ideas are expressed verbally, by writing and by actually doing things. The story chosen has a situation involving action, plenty of human interest, and allows freedom of expression. It was selected from Book I of the Mother Tongue by Arnold and Kittredge, and is entitled "Kindness to Animals." In this test the story was read, a passage of the story was written on the blackboard and the children were then told to illustrate the passage by drawing and to use as much of the story as they could remember to help them make a good drawing. Success depended in the first instance upon the attention given, and upon auditory, visual and retentive memory.

(a) Children with mental ages below X years stand a poor chance of succeeding with a test of this sort.

(b) In the group of children who were tested mentally, it is not the "at age" children, that is the children whose mental ages correspond to their chronological ages, who form the larger per cent. of successes.

(c) Disregarding the over-age or retarded group,

MENTAL AGE	PER CENT. SUCCESSFUL
XII	95
XI	79
X	57
IX	20
VIII	30
VII	8

Summary: Success may be expected of normal fourteen-year-old children.

9. Three-Detail Drawing Test: This test is similar to that described in No. 8, but is for younger children. A simple story is read which contains a specific statement of facts which are used as a basis of the three-detail drawing test. The whole story is read to the children, the special quotation containing the detail was written on the blackboard, and the children are told to draw the three principal details in the quotation. The papers were classified by grades to find out if a curve of successes would correspond to that in the four-detail test.

Summary: The average child found in the second grade, or normal eight-year-old children can perform this test.

10. Balance Nickel (This and the following tests were worked out by Investigator Jessie L. Herrick, M. D., in the Dunkirk Public Schools): The need of performance tests for young children caused the Bureau to experiment with balancing a nickel. A new coin balances too easily and a very old one that is worn off on the edge will not balance at all. Therefore, a moderately used coin is best to use, and if this test should become standard it would be necessary to have the coins to be used tested as to flatness of their edges. It is probable that children will take more pleasure in trying to balance a real nickel than a metal disk of like size. A level table is necessary and a stop watch is used for timing the reaction.

Summary: All normal six-year-old children can balance the nickel when two hands are used. Normal children from the age of seven years can do it with one hand.

11. Peg Board: The idea of using the kindergarten peg board as a motor co-ordination test was gained from the Neurological Institute psychologists. The peg board is of wood, six inches square, 3-8 of an inch thick, with a square of 100 holes bored in it, ten in a row, 1–2 inch apart, the holes being 1–8 of an inch in diameter and a quarter of an inch deep. One cylindrical wooden peg is used, 1–16 of an inch long and of a size to fit the hole. The end of the peg is whittled a little toward a point so that it will enter the hole without resistance, for the speed is materially lowered by friction in the insertion of the peg. For perfectly standard work a metal board and stylus made to exact proportions would be de-

sirable. However, an examiner becomes familiar with his own tools and can easily detect individual differences in the persons he examines. A stop watch is used to time the reaction.

Summary: Time and method are the determining factors in this test. All normal children from the age of six years can do it. Ten-year-old children can do it in 65 seconds using the alternative method.

12. Tower: The tower test is one planned by the Bureau to use with young children, and is in three sections, the building of the tower, raising it from the floor to the table, and packing it together in the smallest possible compass. A nest of boxes such as is sold at ten-cent stores is used. The outer box is 3¼ inches or 3½ inches square, and there are seven or eight boxes diminishing in size until the smallest is 2½ inches tall and slightly less than an inch square. Each box except the smallest has one side left open. The boxes are covered with brightly colored pictures which please the children. Moreover, the toy is of a kind familiar to most all children and so raises no fear in them.

Summary: Build: Normal ten-year-old children may be expected to build the tower in an average time of 28 seconds.

Raise: Time and the number of blocks off are the principal elements in this part of the test. A normal ten-year-old child may be expected to raise the tower in 58 seconds with no more than two blocks off.

Pack: A normal nine-year-old child may be expected to pack the blocks in an average time of 22 seconds.

13. Boat: Four pieces of cardboard, of a size that can be kept in a small envelope. A boat is marked 300 lbs., meaning that the boat will carry three hundred pounds, a large man, usually referred to as "the fat man," marked with his weight, 300 lbs., two little men, just of a size, each marked with their weight, 150 lbs.

Summary: A normal ten-year-old child or a subject with a ten-year-mentality may be expected to perform the boat test with not more than two protests.

With the excpetion of the last four tests the working norms were obtained from the results of a selected group of public school children, all of whom had made the average yearly progress from grade to grade. The results of the work of the institution group, for the most part do not come up to expectation when compared with that of the public school group, but this is due to the fact that in the former group the backward children tend to lower the averages of those children in the institutions whose work is comparable to the normal public school children. The results show that in tests involving reasoning and prolonged concentration, the institution children as a group make a poorer showing than the selected groups of public school children, while with simple performance tests and tests that are quite mechanical the results of the two groups are more nearly alike.

MENTAL EXAMINATIONS—BULLETIN NO. XI.

This Bulletin concerns mental examinations of orphan asylum children. Psychometric examinations of children in twenty-three child-caring institutions were made. Of 2142 children tested, 143 were diagnosed as feeble-minded. The number tested, 2142, represents a fair sized sample of the 35,000 children in orphan asylums iin New York State. If less than 7% of orphan asylum children are feeble-minded, the situation is not so grave as has been pictured, but it implies the presence in the State of 2100 feeble-minded probably dependent children. It should not be assumed that the remaining 93 or 94% of orphan asylum children are fully normal, as many of them are retarded, dull, subnormal, or border-line cases. The heredity background of such a group of children is one which naturally presents itself for investigation by the sociologist. The families of all such children, including American types of parents, have been found more difficult to analyze than naturally would be supposed. The reason for this is that they have not realized that their child is defective or that he is a special problem. If the child does not do well in school work it is not recognized as an important matter by parents who are themselves more or less illiterate.

The study illustrates the need for special groups in schools and children's institutions where scholastic training will be given in proportion to mental capability. Those who are markedly defective should be removed from the school and committed to special institutions. Such children as are allowed to leave school should have a suitable occupation found for them, should work outside only when on probation, which should be extended for an indefinite period. Those failing in this plan would get along in a suitable colony where they could to some extent enjoy the fruits of their labors without being allowed the right of reproduction.

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EDITORIAL

PEACE PROBLEMS

The war is over. Victory is won. The kind of peace for which we have fought is assured. Now we are confronted with problems of re-organization and rehabilitation, upon the successful solution of which depends the future prosperity of the world. Old ideas and conceptions are in the crucible. The tremendous political and social upheavals of central and eastern Europe are having their reverberation in the mutterings of social unrest in western Europe and America. Having made the world safe for democracy we are now face to face with the task of developing a democracy that is safe for the world. In a broad but very real sense this is a task of education.

Our educational leaders are by no means oblivious to the present need. From the press, the pulpit and the platform comes the recognition that the future welfare of the country rests upon education. Within a fortnight two of our most conspicuous educators, Ex-president Eliot, of Harvard, and President Butler, of Columbia, have discussed the future needs of education at some length. Dr. Eliot reiterates and amplifies his well-known view that in our edu-

cation we should pay more attention to the creative and interpretive activities of hand and voice. The eye should be trained to see, the ear to hear, and the hand to execute. This should be brought about through more intensive studies of the world in which we live, a greater emphasis upon the natural and social sciences, the interpretation of history in the light of present needs, and a more adequate utilization of the fine and industrial arts. Particularly do we need to divest our educational procedure of much of the formalism with which it has become encrusted, and to vitalize it by making it both more utilitarian and more idealistic. The paramount task of present education is to formulate and render articulate the inchoate demands of the new social outlook, and to devise methods of procedure which shall attain most effectively and economically the desired ends.

According to Dr. Butler the war has burnt up much of the dross and crudity of our earlier educational mintage, has torn to shreds the false psychology and economics of the "superman," and has reaffirmed the supremacy of the moral ideal. Further development of the moral ideal calls for training in ethics, economics and politics, as the fundamental verities in education. "There will be much more attention paid to the determination of individual differences of taste and capacity, and to making provision for them. The object of this determination is to prevent waste of effort, the loss of opportunity, and the blunting of talent by trying to sharpen it upon the wrong whetstone." Old methods of teaching come in for much criticism, particularly the teaching of physics, chemistry, biology and foreign languages. The elementary school is roundly secored for neglecting its proper business of thorough grounding in the fundamentals, and of running off after faddists and enthusiasts.

All of this is very interesting, but decidedly vague and sweeping. In regard to many aspects of our educational procedure, whether elementary, secondary, or college, we are in precisely the same position in which President Wilson recently confessed to Congress he found himself with reference to the railways: We do not know. Let us then frankly adopt the attitude of inquirers, both as to subject matter and as to method. Let us call for tests, as objective and scientific as may be, of what is being done and what is proposed. Let us demand, and let us train the public to demand, more experimentally verified fact and less dogmatic personal opinion. Let us grapple with the educational problems of peace as intelligently, as enthusiastically, as whole-heartedly as we did those of war. But let us above all things, in season and out of season, demand that we " be shown."

J. C. B.

NOTES AND NEWS

A preliminary meeting of the New York Society for the Experimental Study of Education was held at the Washington Irving High School, Friday evening, October 18. The general topic of the meeting was "What are the problems in education that are in most urgent need of experimental investigation, and how can this society proceed most successfully in attacking these problems?" The following papers were presented: "The Value of Experimental Studies for the Superintendent," Associate Superintendent Gustave Straubenmuller; "Opportunities for Experimental Study in Secondary Schools," Principal Arthur M. Wolfson, High School of Commerce; "Experimental Studies from the Principal's Point of View," District Superintendent Arthur C. Perry, Jr.; "The Teacher's Gain from Experimental Studies," Professor Thomas H. Briggs, Teachers College.

The council of the American Psychological Association first decided to abandon the annual meeting scheduled for December, 1918, on account of the exigencies of the war and the preoccupation of the members with war work. The signing of the armistice has led the council to reconsider its decision, and a brief meeting will be held at Baltimore, December 27 and 28, for the consideration of topics growing out of the war.

The temporary officers of the American Association of Clinical Psychologists at first deemed it advisable to cancel the annual meeting scheduled for December, 1918. After the cessation of hostilities, however, the plans were again changed, and a brief meeting will be held in Baltimore. The temporary officers of the Association are as follows: Chairman, J. E. Wallace Wallin; Secretary, Leta S. Hollingsworth; Committee on Constitution, Leta S. Hollingsworth, David Mitchell and Francis N. Maxfield; Committee on nomination of officers and new members, Rudolf Pintner, Helen Thompson Woolley and H. H. Goddard; Committee on program for the next meeting, the Chairman, secretary and the committee on constitution.

The summer training school of psychiatric social work conducted by the Boston Psychopathic Hospital and Smith College under the auspices of the National Committee for Mental Hygiene opened at Smith College July 7th with an enrollment of 68 young women from 21 states and as many colleges. The purpose of the school was to give in eight weeks the theoretical background necessary to prepare social workers to assist in the rehabilitation of soldiers suffering from "shell shock" and other nervous and mental disorders. The list of instructors included many well-known names, and a wide range of subjects was given which covered the field very thoroughly. Of the 58 students who completed the work satis-

factorily, those who had not previously had the required amount of practical work were assigned to various clinics and hospitals for further training.

The committee on educational psychology of the Society of College Teachers of Education, Professor Frank N. Freeman, chairman, has prepared and distributed a questionnaire designed to bring out just what type of work is given in the various institutions under the name of educational psychology.

The Bureau of Cooperative Research of Indiana University, under the direction of Dr. Walter S. Monroe, has issued an announcement of plans for investigations in 1918–1919, and a list of standardized tests for sale by the Bureau. Among the projects noted are the further standardization of Monroe's reasoning tests in arithmetic, a study of common errors in arithmetic, reading and spelling, and the collection of effective methods of correcting errors in these subjects.

The Bureau of Educational Experiments, 16 West 8th Street, New York City, announces the issue of Bulletin No. IX, *Psychological Tests, Revised and Classified*. This bulletin is said to be a much more extensive collection of material than their former Bulletin No. VI, and to include publications to October 1, 1918.

The General Education Board announces the publication of the Gary Survey in eight parts, as follows: I. *The Gary Schools: A General Account*, by Abraham Flexner and Frank P. Bachman; II. *Organization and Administration*, by George D. Strayer and Frank P. Bachman; III. *Costs*, by Frank P. Bachman and Ralph Bowman; IV. *Industrial Work*, by Charles R. Richards; V. *Household Arts*, by Eva W. White; VI. *Physical Training and Play*, by Lee F. Hanmer; VII. *Science Teaching*, by Otis W. Caldwell; and VIII. *Measurement of Classroom Products*, by Stuart A. Courtis. The parts vary in length from 34 to 350 pages and cost from ten to thirty cents. They will be published at brief intevals beginning December 1.

Dr. S. L. Pressey, of Indiana University, has devised a group scale for the measurement of intelligence. The tests consist of rote memory, logical selection, arithmetic problems, opposites, logical memory, word completion, moral classification, dissected sentences, practical information, and analogies. Tests of over 1000 school children indicate a good correlation with the Stanford-Binet scale and with the judgments of teachers.

The State Board of Health of California has created a bureau of child hygiene to study the child health of the state. Miss Amy D. Steinhard has been placed in charge of the bureau.

Dr. Lotus D. Coffman, dean of the school of education of the University of Minnesota, has been appointed head of the work by the War Department on the reconstruction of crippled and injured soldiers, succeeding Dean James E. Russell, of Teachers College, Columbia University.

Professor E. A. Bennett, dean of Highland College, Des Moines, Iowa, has accepted the chair of education at Boston University.

Dr. Joseph Peterson, assistant professor of psychology in the University of Minnesota, has resigned to accept a professorship in psychology in George Peabody College for Teachers, Nashville, Tenn.

Miss Frances Lowell has been appointed instructor in psychology at the University of Minnesota.

Dr. Walter B. Swift, of Boston, has been appointed consultation expert for speech defects to the division of medical inspection of the public schools of Cleveland, Ohio.

Mr. George A. Mirick, formerly deputy commissioner of education in New Jersey, has been appointed assistant professor of education at Harvard University.

Professor Lightner Witmer, head of the department of psychology at the University of Pennsylvania, has returned from his work with the Red Cross in Italy, and is on active duty this year.

Captain Madison Bentley is now president of the Aviation Examining Board, examining aviation recruits from New England colleges.

Dr. Roswell P. Angier, professor of psychology at Yale University, is a captain in the Sanitary Corps, National Army, at the Hazelhurst Field Medical Research Laboratory, Mineola, L. I.

Dr. Ernest N. Henderson, professor of philosophy and psychology at Adelphi College, has been commissioned captain in the Sanitary Corps.

A new volume by Professor Thorstein Veblen, of Cornell University, entitled *The Higher Learning in America: A Memorandum on the Conduct of the Universities by Business Men*, is announced for early publication by B. W. Huebsch.

Among the forthcoming books announced by Longmans, Green and Company are *The New State*, by M. P. Follett, which presents group organization as the solution of problems in popular government; *The Citizen and the Republic*, a textbook in government, by James Albert Woodburn and Thomas Francis Moran; and *The Human Machine and Industrial Efficiency*, by Frederick S. Lee.

PUBLICATIONS RECEIVED

JAMES ROWLAND ANGELL. *An Introduction to Psychology.* New York: Henry Holt and Company, 1918. Pp. vii. 281.

This is not a mere condensation of the author's older and larger work, but a fresh survey of the entire field of psychology. "The *organizing* character of every level of our psychological activities is more explicitly brought out than in the older book, with advantage, I trust, to the depth and vividness of impression left on the reader's mind regarding the real nature of our adjustments to environment." Without going to the extreme of rejecting introspection entirely, the author manifests a strong leaning toward the behavioristic point of view. Particularly the doctrine of imageless thought and of the influence of subconscious neural activities upon the stream of consciousness are regarded with increasing favor. It is noteworthy that the ancient, atomistic conception of instinct is still dominant, and that Thorndike's vigorous onslaught on this doctrine has had little effect on the discussion. As a simple introductory outline the book will undoubtedly prove highly serviceable.

HERBERT BATES. *English Literature.* New York: Longmans, Green and Company. 1918. Pp. xiv, 605. $1.50.

What a striking contrast is this book with the dull, sombre histories of English literature of our early memories! Here we have an abundance of illustrations from old prints or the reproductions of great masterpieces, many choice selections illustrating the excellencies which the author extols, numerous diagrams, a fascinating literary map of England, and an abundance of helpful guides to further reading. The text itself tells a delightful story and should make the study of English literature as absorbing as it formerly was stupefying.

The Boston Way. Plans for the Development of the Individual Child. Compiled by the Special Class Teachers of Boston. 1917. Pp. 127, $1.00.

This little book is packed with valuable suggestions for teachers of backward or defective children. The forty-two school subjects included range from arithmetic, reading and spelling to cobbling, crocheting and brush-making. True, the psychology is still in the faculty stage, and sense training is taken for granted, but the incidental theory does not at all nullify the value of the ingenious and diversified practical recommendations.

JEAN BROADHURST. *Home and Community Hygiene.* Philadelphia: J. B. Lippincott Company. 1918. Pp. xiii, 428. $2.00.

This is one of the excellent Lippincott's Home Manuals series under the editorship of Benjamin R. Andrews, of Teachers College. The sub-title is "A Text-book of Public and Personal Health." There is a distinct need for a book that brings together in popular, untechnical language the latest results in the science of healthful living. The present volume performs this service admirably and deserves a very wide circulation.

HENRY REED BURCH AND S. HOWARD PATTERSON. *American Social Problems, an Introduction to the Study of Society.* New York: The Macmillan Company, 1918. Pp. ix, 381. $1.20.

It is remarkable how the social sciences, the sciences of man, have been neglected in our secondary curricula. We talk much of our education as a preparation for

living, yet we avoid any systematic effort to make the bases of social life comprehensible. The present book aims to present in very elementary fashion some of the essential features of our social organization. From the point of view of the evolutionary conception the development of civilized from primitive man is sketched, the influence of climatic and physiographic features is indicated, the development of the family and the state is outlined, and such problems in American social life are discussed as immigration, the negro race, industrial adjustment, poverty, charity and crime, the evils of mental defect, drink, and divorce, and the function of the school and other social agencies in moral progress. The book should stimulate high school students to reflection and wider reading on social questions.

ARTHUR D. DEAN. *Our Schools in War Time and After.* Boston: Ginn and Company, 1918. Pp. v, 355. $1.25.

The problem of how we can utilize the energies and activities mobilized for the war to the betterment of the training of our children for lives of peace is occupying the attention of all thoughtful students of education. The first requisite is a survey of the work that our schools have done during war time, and this is admirably presented in the volume before us. There is an account of the response of our schools to war needs, the services rendered by industrial and trade schools, colleges and technical institutes, war activities in manual and household arts, organizing boy power, red cross, re-education of the disabled, farm cadets, and a program for the future. The discussion points the way to many modifications of school procedure that will be useful in peace as well as in war.

MARY DUCLAUX. *A Short History of France from Caesar's Invasion to the Battle of Waterloo.* G. P. Putnam's Sons, 1918. Pp. ix, 345. $2.50.

The author states that she has written this book neither for schoolboys nor historians, but for the great mass of cultivated but ignorant men and women who, particularly at the present time, desire to know more of the past of that heroic sister republic to whose aid we have given of our best. She has given us a vivid, stirring tale in which the great figures of French history stand out with lifelike distinctness. It is not a social, political or industrial history so much as a history of striking personalities. It is this character that lends the book its enthralling interest.

ABRAHAM FLEXNER AND FRANK P. BACHMAN. *The Gary Schools, A General Account.* New York: General Education Board, 1918. Pp. vi, 265. Twenty-five cents.

This is the first of the reports on the survey of the Gary schools by the General Education Board. It gives the general plan of the survey, summarizes the important findings that will be presented in greater detail in subsequent reports, and draws conclusions as to the significance of the survey as a whole. Salient features of the latter are the credit due to Gary for adopting a modern and progressive school policy, the plan of organization for presenting an enriched curriculum at a minimum expense, democratic practice in school discipline, lack of watchful administrative control, defective supervision, and some poor teaching.

GRACE FULMER. *The Use of the Kindergarten Gifts.* Boston: Houghton Mifflin Company, 1918. Pp. vii, 232.

This discussion of fundamental principles of kindergarten education is founded firmly on the modern psychology of adjustment. It is an attempt to interpret the traditional materials of the kindergarten in terms of modern ideas and to free them from the mystical obscuration of the orthodox Froebellian exposition. The attitude toward Froebel is sympathetic not critical, and the book has grown out of long experience in the kindergarten and in training kindergarten teachers.

WILLIAM ERNEST HOCKING. *Human Nature and its Remaking.* New Haven: Yale University Press, 1918. Pp. xxvi, 434. $3.00.

This is one of the most profound and significant books of this generation, and yet withal so interestingly and attractively written that it reads like a fairy tale. It is an attempt to establish a system of moral and social values upon a consistent biological basis. The units of this biological structure are the instincts. The author acknowledges that the conception of instinct is purely hypothetical, that the examination of any specific bit of human behavior reveals a complex of habits wrought out under the pressure of experience from the primitive materials of inherited structure and function. The argument shows that he is perfectly familiar with Thorndike's searching analysis of these hypothetical units. Nevertheless, he finds it convenient for his purpose to assume the existence of these composite structures of heredity and experience, and then proceeds to show how there grow out of these native tendencies such complex attitudes as the will, conscience, sin, social and political obligation, and religious beliefs and aspirations. The book might well be called a natural history of social and moral control. It is of tremendous significance for the theory of education.

E. M. JAMISON, AND OTHERS. *Italy, Medieval and Modern.* New York: Oxford University Press, 1917. Pp. viii, 564. $2.90.

The part that Italy has played in the recent world-war arouses an interest in her development which will make the present volume very acceptable. "Our historical literature is full of admirable monographs on particular epochs of Italian history . . . . Yet it is strangely difficult to find any general sketch of Italian history, from the barbarian invasions to the present day, which can be recommended as an introduction to more detailed studies. It was to supply this need that the present volume was planned and written."

CHARLES HUBBARD JUDD. *The Evolution of a Democratic School System.* Boston: Houghton Mifflin Company, 1918. Pp. ix, 119.

"The feeling has been steadily gaining strength that our generation must shake off the institutional traditions of a past age and organize a sound scheme of democratic education. The present study is an effort to bring out explicitly some of the justifications for the reorganizations which are now under way. The book aims to bring to clearer consciousness the unique characteristics of our continuous educational system. It aims to point the way by which much of the present waste of pupil's time and energy can be corrected. It is a plea for a tolerant attitude toward the crudities of the junior high school. It is a plea for more co-operation in developing this institution."

CHARLES HUBBARD JUDD, AND OTHERS. *Reading: Its Nature and Development.* Chicago: The University of Chicago Press, 1918. Pp. xiv, 192. $1.00.

The present monograph gives a summary of the extensive investigations in reading which have been carried on at the University of Chicago for the past two or three years with the financial support of the General Education Board. The chapters deal with changes in the teaching of reading, a study of reading books, eye-movements of adult readers, analysis of children's reading, special training in reading, progress through the grades, individual differences, and reading for meaning. The author urges greater emphasis on reading for meaning in the upper elementary grades.

EDGAR JAMES SWIFT. *Psychology and the Day's Work.* New York: Charles Scribner's Sons, 1918. Pp. ix, 338. $2.00.

This book might aptly be called the browsings of a psychologist. The author takes his texts from the newspapers, from literature, from business, from the war, from the history of science, from the frailties and foibles, the grandeur and heroism of man wherever he finds them, and out of these develops the most entertaining reflections. The most significant chapters for the teacher are those on the psychology of learning, curiosities of memory, memory and its improvement, and the psychology of testimony and rumor. While there is no systematic exposition of any particular psychological creed, the author's psychology is always sound and rests upon well established experimental data. Indeed the author's avowed purpose is to present the essence of experimental psychology in such untechnical and attractive form that the layman can and will become acquainted with it and profit by it.

LEWIS M. TERMAN. *A Trial of Mental and Pedagogical Tests in a Civil Service Examination for Policemen and Firemen.* Reprinted from the Journal of Applied Psychology, 1: 1917, 17–29.

The tests used were the Trabue Completion Tests, the Thorndike Reading test, the Ayres scale for handwriting, a spelling test based on Starch, and the Courtis Arithmetic, Series A. The Stanford revision of the Binet tests was used. The intelligence quotients varied from 60 to 114, median 84. The highest correlation was between mental age and arithmetical reaoning (.81).

CHARLES W. WADDLE. *An Introduction to Child Psychology.* Boston: Houghton Mifflin Company, 1918. Pp. xvii, 317. $1.50.

This book is a valuable addition to the growing literature on child psychology. The first five chapters give the historical and biological background of child psychology, chapters six to nine deal with play, linguistic development, children's drawings, and the moral development of children, chapter ten discusses juvenile delinquency, and the last two chapters present the general facts and principles of mental development and the unfolding of specific capacities. Each chapter is followed by a summary, a list of questions, and a fairly extended bibliography. It is strange that the author in his chapter on "Non-learned Human Behavior" quotes extensively from McDougall, Hall and others, but almost entirely ignores the critical work of Thorndike.

HOWARD C. WARREN. *The Mechanics of Intelligence.* Reprinted from the Philosophical Review, 26, 1917. Pp. 602–621.

The central problem of this paper is how does intelligence act on voluntary muscles. An interesting illustration in the course of the discussion is an analysis of the controls involved in playing a game of chess. The author's conclusion is that intelligence has no causal significance whatever, but is merely the accompaniment of neural activities which are as mechanical in their nature as other physical and chemical changes.

ARLAND D. WEEKS. *The Psychology of Citizenship.* Chicago: A. C. McClurg and Company, 1917. Pp. 152. $0.50.

Since citizenship demands intelligence any study of the activities of intelligent citizenship may have a certain right to be called psychology. Of psychology in the modern critical, analytical sense this book contains little. Yet it is a good book, stimulating, thought-provoking, liberalizing. The chapter on the control of suggestion, for example, gives a splendid account of the factors in contemporary life which exert effective control over our conduct.

DAVID EMRICH WEGLEIN. *The Correlation of Abilities of High School Pupils.* The Johns Hopkins University Studies in Education, No. 1. Baltimore: The Johns Hopkins Press, 1917. Pp. 100. $1.25.

This is a careful study of the relationships found in the high school marks of a group of 255 girls in the subjects of the course of study taken separately by years. There is first a good summary of previous studies in correlation, than an examination of each year's records in detail, and finally a report on three mental tests given to certain members of the group.

Whittier State School. Biennial Report. Whittier, California, 1917. Pp. 245.

Sixty-seven pages of this volume are devoted to the report of the Department of Research, which is under the directorship of Dr. J. Harold Williams. Among the topics discussed are the nature and scope of research in such an institution, a popular account of the measurement of intelligence,heredity and delinquency (with many valuable case studies), environmental factors in delinquency (with the application of the Whittier Scale for Grading Home Conditions), and problems in the study of delinquency. The report of the education department gives the results of several standard tests. The report as a whole sets a high standard of scientific and typographical excellence.

J. HAROLD WILLIAMS. *Delinquency and Density of Population.* Reprinted from the Journal of Delinquency, 2: 1917, 74–91.

The evidence shows that the popular belief that crime is more characteristic of cities than of the country is an error. Delinquency is most prevalent in small towns. There is no particular class of offenses associated with cities, towns or rural communities. The intelligence of delinquent boys from cities is higher than that of boys from the country.

LEON L. WINSLOW AND AUGUST P. GOMPF. *The Industrial Arts in Elementary Education.* Bowling Green, Ohio: Published by the Authors, 1917. Pp. 110.

Disciplinary manual training has had its day, and now gives place to the industrial arts. This suggestive little outline for the utilization of industrial arts material will be a boon to progressive elementary teachers. The topics include stone, clay and glass products; me al products; wood manufactures; chemical products; paper products; books and printed products; textiles and clothing; and foods. There is a list of products for each grade, a classification of industrial products, and a list of helpful reference books.

HERBERT WOODROW. *The Faculty of Attention.* Reprinted from the Journal of Experimental Psychology, 1: 1916, 285–518.

The author has chosen his title deliberately. He contends that as a result of extended experimentation with touch, sound and light re-actions he cannot escape the conviction that "every individual has a certain power or faculty of attention, in the sense that the degree of his attention is determined in part by general conditions which remain effective in spite of variation in the specific type of the mental activity in question." But this seems to be nothing more marked than the "learning type," wherein we find some people fast learners and others slow, no matter what the material they are learning. Yet one does not ordinarily hear of "the faculty of learning."

C. S. YOAKUM AND MARY C. HILL. *Persistent Complexes Derived through Free Associations: Miss Z's Case.* Reprinted from the Journal of Abnormal Psychology, October, 1916. Pp. 45.

This is a case of remarkable facility in remembering the Binet letter squares, in which it developed that the subject made use of highly fantastic free association stories to hold the letters in their order. Examination of these stories led to the discovery of peculiar suppressed complexes that had a strong influence on the subject's general reactions.

C. S. YOAKUM AND MARY C. HILL. *Genetic Antecedents of Free Association Materials: Miss Z's Case.* Reprinted from the Journal of Abnormal Psyhology, February, 1917. Pp. 15.

An account of the previous history of the subject described in the earlier paper, and an explanation of the origin of the tendency to invent "stories" to assist in meeting situations.